



RIO COUNTRY REPORT 2015: TURKEY

2016

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Abstract

The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

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Foreword

The report offers an analysis of the R&I system in Turkey for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Turkish research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The quantitative data is, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in February 2016.

Acknowledgments

The report has been jointly reviewed, under the coordination of Mr Hande Alpaslan, by the main STI actors from the public sector including key Ministries and funding agencies i.e. Ministry of Science, Trade and Innovation, Ministry for EU Affairs, Ministry of Development, Ministry of Finance, The Council of Higher Education, Turkish Patent Institute, Turkish Statistical Institute, TUBITAK, KOSGEB, and Technology Development Foundation of Turkey through a consultative and a consensus building process.

Executive summary

Turkish economy ranks 18th in the 2014 list of world economies with €720,640m (\$806,108m) value of total Gross Domestic Product at current prices (IMF, 2015)¹. The country has a population of 77.695 m² (TURKSTAT, 2014), would account for approximately 15.12%² of the population of the EU-28 (EUROSTAT, 2014). 67.71% of the population of Turkey is between 15-64 years of age and 36.21% is younger than age 30³. The annual average growth rate of GDP was approximately 3% for the last three years, and Turkey achieved a GDP growth rate of 11.6% at current prices⁴ in 2014.

R&D intensity in Turkey is %1.01 in 2014⁵ (TURKSTAT,2014) and it is below the EU-28 average of 2.03% predicted for 2014⁶ (EUROSTAT, 2014) In 2013, GERD increased by 13.4% compared to the previous year. In 2014, GERD was €6.204m (TL 17.598m) which increased by %18.8 compared to previous year⁷. The Business Expenditure on Research and Development (BERD) expenditures in Turkey in 2014 was €3,088.3m (TL8,760m); the Higher Education R&D (HERD) was €2,514.6m (TL7,132.7m); Government Expenditure on R&D (GOVERD) stood at €601.2m (TL1,705.4m)⁸ (TURKSTAT, 2015). The government make a budget of €707.41m (TL2b) for the Supreme Council of Science and Technology in 2015⁹. Furthermore, according to TURKSTAT in 2014 50.9% of R&D expenditure was financed by business enterprises, 26.3% by government sector, 18.4% was by higher education sector, 3.4% by other national sources and 1.1% financed by foreign funds¹⁰.

The total number of FTE personnel were 115,444 in 2014 which is 54%¹¹ of the total R&D personnel. Among FTE personnel 61,945 were employed by the business enterprises, 12,230 by the government sector and 41,269 were employed by the higher education sector¹².

¹ <http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx> Published in April 2015, €1=\$1.1186 (Central Bank of Turkey's cross rate, 30.05.2015).

² <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18616>. In fact the data of TURKSTAT and EUROSTAT conflicts for the population of Turkey in 2014. EUROSTAT declared it as 76.667m and the share calculated for the share of Turkey over the estimated population of EU-28.

http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&lang=en On the other hand World Bank declares the population the country in 2014 as 75.84m. <http://data.worldbank.org/country/turkey>

³ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18616>

⁴ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18728>

⁵ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18661>

⁶ Predicted values for 2014:

<http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tsc0001&plugin=1>

⁷ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18661>

⁸ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18661> Published 17 Nov 2015, €1=TL2.8365 (Central Bank of Turkey's banknote selling rate in 31.12.2014)

⁹ https://pbk.tbmm.gov.tr/dokumanlar/2015_merkezi_yonetim_butce_tasarisi.pdf

By 31.12.2014, €1=TL2.8365 (Central Bank of Turkey's banknote selling rate)

¹⁰ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18661>

¹¹ Calculated from the table reached from

www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=1620

¹² <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18661>

At the 23th meeting of BTYK convened in 27 December 2011, the National Innovation System and National R&D targets for 2023 were determined¹³. These are as follows:

- Achieving an R&D intensity of 3%.
- Increasing business R&D expenditures as a percentage of GDP to 2%, Increasing the number of FTE researchers to 300,000
- Increasing the number of FTE researchers in the private sector to 180,000

The 28th meeting of BTYK took three new decisions¹⁴:

- Launching studies on the development of R&D strategies of universities
- Attempts towards increasing the quantity and quality of human capital holding a Ph.D. degree
- Improvement and implementation of international incubation center support.

There is a clear shift from horizontal focus to sectoral focus in Turkish R&D and innovation policies. In Turkey, following the adoption of the National Science, Technology, and Innovation Strategy 2011-2016 by the Supreme Council for Science and Technology (SCST), there has been a paradigm shift towards a target and mission-oriented approach. Based on the Strategy, clear target figures have been set in terms of government R&D investments. Accordingly, nine priority areas have been adopted. These priorities include automotive, machinery-manufacturing, ICT, energy, water, food, health, space, and defence sectors. This strategic approach was enhanced with the aid of sector specific strategy documents in Turkey. The sector-oriented standpoint was promoted by two result-driven and targeted call based funding programs of TÜBİTAK, which is the main funding authority for R&D in Turkey.

Another remarkable shift is the move from research to innovation. In addition, research and innovation is increasingly seen as a driver for competitiveness and growth and jobs in many sectors and to stimulate investment in general. This still requires a comprehensive strategy on how to achieve this.

With respect to innovation, Turkey has taken several measures identified in the Innovation Union flagship but more substantial reform is expected, as Turkey intends to do, in particular to stimulate cooperation between Academia and Industry and develop new technologies and products.

Although the importance attached to innovation is to be welcomed, this should be balanced with reform on research, and the universities and infrastructures and human capital building both quantitatively and qualitatively, again in line with the key ERA priorities, in order to cover the whole chain from the lab to the market.

According to the Innovation Union Progress Report of 2014, Turkey is a low performer for the European innovation indicator. This was the result of low performance in most components of the innovation indicator¹⁵. However, the European

¹³ <https://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁴ <https://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁵ See Section 6 for a more detailed discussion.

Innovation Scoreboard 2016 introduces Turkey as a **Moderate Innovator**¹⁶. Turkey is catching up to the EU; its relative performance has improved from 38% in 2008 to 39% in 2014 and then jumped to 51% in 2015 turning the country from a Modest into a Moderate Innovator.

¹⁶ http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en

Yönetici Özeti

Türkiye ekonomisi, 2014 yılında €720,640m'luk (\$806,108m) bir Gayrisafi Yurtiçi Hasıla (GSYİH) (cari fiyatlarla) ile dünyada 18. sıradadır. Son üç yıl içinde, yıllık ortalama GSYİH büyüme oranı %3 olarak hesaplanmakta, cari fiyatlar ile bu oran 2014 yılında %11.6 olarak verilmektedir.

2014 yılı verilerine göre Türkiye'de Ar-Ge yoğunluğu %1.01 (TÜİK, 2014) ile AB-28 ülkeleri ortalaması olan %2.03'den daha düşük bir düzeydedir. Gayrisafi yurtiçi AR-GE harcaması bir önceki yıla göre %18.8 artarak €6,204m (TL17,598m) olarak hesaplanmıştır. TÜİK verilerine göre, 2014 yılında Ar-Ge harcamalarının %50.9'u özel sektör tarafından, %26.3'ü devlet tarafından, %18.4'i yüksek öğretim kurumları tarafından, %3.4 diğer ulusal kaynaklardan ve %1.1'i uluslararası fonlardan karşılanmıştır. Yine 2014'te BERD (Ticari kesim tarafından finanse edilen Ar-Ge Harcaması) €3088.3m (TL8,760m), HERD (Yükseköğretim kesimi tarafından finanse edilen Ar-Ge Harcaması) €2514.6m (TL7,132.7m), GOVERD (Kamu kesimi tarafından finanse edilen Ar-Ge Harcaması) €601.2m (TL1,705.4m) olarak belirtilmiştir. Devlet, BTYK'ya €707.41m (TL2b) bütçe ayırmıştır.

2014 yılında toplam 115,444 kişi, Ar-Ge personelinin %54'ü tam Zaman Eşdeğeri (TZE) cinsinden çalışmıştır. Bir önceki yıla göre TZE cinsinden Ar-Ge personeli sayısındaki artış %2,2 olmuştur.

28. BTYK kararları, 27 Aralık 2011'de yapılan 23. BTYK kararlarında belirlenen 2023 Ulusal Yenilik Sistemi hedefleri ile uyumlandırılmıştır. Bu genel hedeflerin yanı sıra 28. BTYK kararlarında üniversitelerde Ar-Ge stratejilerinin geliştirilmesi üzerine çalışmalar başlatılması, doktora derecesi olanların sayısını ve beşeri kapasitesini arttırmak için girişimde bulunulması, uluslararası kuluçka merkezi destek mekanizmalarının geliştirilmesini sağlamak gibi hedeflere de yer verilmiştir.

Türkiye'de Ar-Ge ve yenilik politikası yatay odaktan sektörel odağa geçmiştir. Diğer bir geçiş ise araştırmadan yeniliğe yönelim olmuştur. Genel olarak araştırma ve yenilik tüm ulusal/bölgesel politika karışımında daha önemli rol oynamaktadır. Ayrıca stratejik, uyumlu ve bütüncül politika çerçevesi geliştirme ve uygulama kararlılığı artmıştır.

2014 Yenilik Karnesi'ne göre, Türkiye Avrupa yenilik göstergelerinde alt sıralarda yer almaktadır. Lakin Türkiye'nin notu, 2016 Yenilik Karnesi'nde 'Makul' seviyeden 'Orta Dereceli Yenilikçi' seviyesine yükseltilmiştir. Türkiye 2008'de %38, 2014'te %39 olan performansını 2015'te %51'e çıkartmıştır. Buna rağmen Türkiye halen üniversite araştırmalarının ticarileşmesini teşvik etmek, yenilikçi yüksek büyüme potansiyeline sahip başlangıç sayısını arttırmak, özel sektörün özellikle mikro, küçük ve orta ölçekli işletmeler (MKOBİ) alanlarında Ar-Ge ve yenilikçilik kapasitesini arttırmak, finansal kaynaklara erişimde stratejik yaklaşıma odaklanmak, araştırma personelinin sayısını ve kalitesini arttırmak gibi yapısal sorunlarla karşı karşıyadır.

1 Overview of the R&I system

1.1 Introduction

Turkey has population of 77.695m¹⁷ (TURKSTAT, 2014), would account for approximately 15.12%¹⁸ of the population of the EU-28 (EUROSTAT, 2014). Country has the second largest population among the EU-28 countries¹⁹. 67.71% of the population of Turkey is between 15-64 years of age and 36.21% is younger than age 30²⁰.

By April 2015, the 2014 total Gross Domestic Product (GDP) of Turkey is estimated to be as €720,640m (\$806,108m) which ranks her 18th in the list of world economies (IMF, 2015)²¹. It is estimated to decline to €672,624m (\$752,510m) in 2015 but this does not cause any change for the rank of Turkey in the world economies²². The GDP per capita in 2014 was €8,562.9 (\$10,404)²³. It is approximately one third of EU-28 average which is €27,300 in 2014 (EUROSTAT,2014)²⁴.

In 2014 Turkey achieved a GDP growth rate of 11.6% and 2.9% in current and constant prices, respectively²⁵. The GDP per capita measured in current prices has increased by 7.8% in the first quarter of 2015 compared to the same quarter of the previous year. The annual average growth rate has been approximately 3% for the last three years.

The unemployment rate is 9.9% in 2014²⁶(TURKSTAT, 2014) and young unemployment rate (between ages 15-24) is 17.9%. The unemployment rate has increased by 0.7 points in three years²⁷.

In 2014, the service sector constitutes 64.9%²⁸ of the GDP, agriculture constitutes 8%²⁹ and industry constitutes 27.1%³⁰. Hi-technology exports constitute 2%³¹ of the

¹⁷ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18616>

¹⁸ In fact the data of TURKSTAT and EUROSTAT conflicts for the population of Turkey in 2014. EUROSTAT declared it as 76.667m and the share calculating the share of Turkey over the estimated population of EU-28.

http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&lang=en On the other hand World Bank declares the population the country in 2014 as 75.84m.

¹⁹ Germany has the highest proportion of EU-28 countries with 15.9%

²⁰ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18616>

²¹ <http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx> Published in April 2015, €1=\$1.1186 (Central Bank of Turkey's cross rate, 30.05.2015)

²² The report of TURKSTAT declare the GDP as €707,245m (TL1749.782b) in 2014.

<http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18728>

Published 10 June 2015, €1=TL3.1050, €1=\$1.1313 (Central Bank of Turkey's banknote selling rate and cross rate respectively in 10.06.2015)

²³ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18727> €1=\$1.2150 (Central Bank of Turkey's cross rate by 31.12.2014)

²⁴ <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>

²⁵ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18728>

²⁶ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18645>

²⁷ http://www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=1323 The EUROSTAT indicates 1.5 points increase in unemployment rate in three years, from 8.4% in 2012 to 9.9% in 2014 : http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=une_rt_a&lang=en

²⁸ <http://data.worldbank.org/indicator/NV.SRV.TETC.ZS>

²⁹ <http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS>

³⁰ <http://data.worldbank.org/indicator/NV.IND.TOTL.ZS>

manufactured exports in 2013. In manufacturing industry, high technology products amounted to 2.7%³² of sales in 2013. It decreased 0.3 points compared to 2012³³. 38.6%³⁴ of the products are low technology ones and this proportion increased in 2013 by 0.6 points³⁵ compared to 2012. Medium-low products constitute 35% in 2013 decreased 1% in one year whereas medium-high products constitutes 23.7% and increased 0.7% in one year.

R&D intensity which shows the ratio of Gross Domestic Expenditure on Research and Development (GERD) to GDP is 1.01% in 2014³⁶ while it is estimated to be 2.03% for EU-28³⁷ (EUROSTAT, 2014). GERD increased in Turkey in 2014 compared to the previous year by 18.8% €6.204m³⁸. Over the period 2011-2014, GERD increased by 0.15 points.

50.9% of total R&D expenditures was financed by business enterprises in 2014 while it was 48.9% in 2013. This source of funding was followed by the government sector by 26.3%, the higher education sector by 18.4%, other national sources by 3.4% and by foreign funds by 1.1%. In 2013, these were 26.6%, 20.4%, 3.3% and 0.8%, respectively^{39,40}. In 2014 the share of business enterprises sector in total R&D expenditure was 49.8%. This sector was followed by the higher education sector by 40.5% and public sector by 9.7% respectively. The first rank was occupied by business enterprise sector by 47.5% in the previous year while the higher education was 42.1% and the public sector was 10.4%. The Business Expenditure on Research and Development (BERD) undertaken in Turkey in 2014 was €3,088.3m (TL 8,760m). In 2014, the Higher Education expenditures on R&D (HERD) was €2,514.6m (TL7,132.7m). Government expenditures on R&D (GOVERD) stood at €601.2m (TL1,705.4m) in 2014⁴¹ (TURKSTAT, 2014). The government unmarked an amount of €707.41m (TL2b) for Supreme Council of Science and Technology⁴².

The most recent data on turnover from innovation as a percentage of total turnover is for 2012 and equals 33.6%⁴³. Turkey has announced GERD/GDP target as 1.80% by 2018⁴⁴ and 3% by 2023, while EU-28 countries targeted to achieve this percentage as

³¹ <http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS>

³² <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18864>

³³ http://www.tuik.gov.tr/basinOdasi/haberler/2014_35_20140605.pdf

³⁴ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18864>

³⁵ http://www.tuik.gov.tr/basinOdasi/haberler/2014_35_20140605.pdf

³⁶ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18661>

³⁷ <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tsc00001&plugin=1>

³⁸ €1=TL2.8365 (Central Bank of Turkey's banknote selling rate by 31.12.2014)

³⁹ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18661>

⁴⁰ <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=16163> Published 20 Nov 2014, €1=TL2.8051 (Central Bank of Turkey's banknote selling rate in 20.11.2014)

⁴¹ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18661> 1€=TL2.8365 (Central Bank of Turkey's banknote selling rate in 31.12.2014)

⁴² https://pbk.tbmm.gov.tr/dokumanlar/2015_merkezi_yonetim_butce_tasarisi.pdf By 31.12.2014, €1=TL2.8365 (Central Bank of Turkey's banknote selling rate)

⁴³ In EUROSTAT, it is included in Community Innovation Survey and published every two years. It will be updated when 2014 data will be published.

⁴⁴ Ministry of Development, 2014, The Tenth Development Plan 2014- 2018

2020⁴⁵ (OECD, 2014). While the ratio of R&D performed by business sector (BERD) to GERD is 49.8 % in 2014, by 2018 it is targeted to be 60%⁴⁶.

Among 35 countries who have a targeted ratio, Turkey has the largest gap between the target and the current proportion. In fact, in 2004 the target for 2013 is defined as 2%, which was 0.64% in 2004⁴⁷ (TUBITAK, 2004). The R&D intensity experienced in 2011 is 0.86 which is below the target of the Ninth Development Plan. If the trend continues, R&D intensity is expected to be 1.27%⁴⁸ in 2020 which is even less than the 2018 target.

During the three years, Turkey faced three elections: local, presidential and parliamentary elections. The election held at 10.08.2014 was the first time people voted directly for the President. The last one was the snap elections for parliament held in November 1, 2015.

Table 1 shows the main R&I indicators for the period 2012-2014.

Table 1. Main R&I indicators 2012-2014

| Indicator | 2012 | 2013 | 2014 | EU average |
|--|-------------|-------------|-------------------|-------------------|
| GDP per capita | €9,923.4 | €10,073.5 | €9,684.4 | €27,300 |
| GDP growth rate (annual %) | 2.1 | 4.0 | 2.9 | 1.3 |
| Budget deficit as % of public budget | 8 | 4.5 | 5.4 ^e | 6 |
| Government debt as % of GDP | 36.5 | 35 | 33.1 ^e | 86.6 |
| Unemployment rate as percentage of the labour force | 9.2 | 9.7 | 9.9 | 10.2 |
| GERD in €m | €5,534m | €5,029m | €6,204m | €283,009m |
| GERD as % of the GDP | 0.92 | 0.95 | 1.01 | 2.01 (2013) |
| GERD (EUR per capita) | 63.3 | 68.84 | 73.745 | 536 |
| Employment in high and medium high technology manufacturing sectors as a share of total employment | 3.0 | 3.1 | 3.2 | 5.7 (2014) |
| Employment in (total) knowledge-intensive service sectors as a share of total employment | 19.8 | 20.1 | 20.7 | 39.7(2014) |

⁴⁵ OECD (2014), National R&D spending targets and gap with current levels of GERD intensity, 2014: As a % of GDP, in *OECD Science, Technology and Industry Outlook 2014*, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/sti_outlook-2014-graph30-en

⁴⁶ Ministry of Development, 2014, The Tenth Development Plan 2014-2018

⁴⁷ Ulusal Bilim ve Teknoloji Politikaları 2003-2023 Strateji Belgesi http://www.tubitak.gov.tr/tubitak_content_files/vizyon2023/Vizyon2023_Strateji_Belgesi.pdf

⁴⁸ Research and Innovation Performance in the EU: Innovation Union progress at country level 2014 pp: 330

| | | | | |
|--|------|------|------|-------------------|
| Turnover from innovation as % of total turnover | 33.6 | -- | -- | 11.9 (2012) |
| Value added of manufacturing as share of total value added | 33.7 | 34.8 | 35.5 | 15.3 |
| Value added of high tech manufacturing as share of total value added | 1.01 | 0.94 | | 1.41 ^e |

1.2 Structure of the national research and innovation system and its governance

1.2.1 Main features of the R&I system

The Turkish R&I system is centralized and led by the Supreme Council of Science and Technology (BTYK), the legally formalized body chaired by the prime minister. There are also 26 Regional Development Agencies (RDAs) which are affiliated to the Ministry of Development (MoD) to encourage R&D and innovation on a regional scale.

1.2.2 Governance

There are different political and operational bodies affiliated to different Ministries which organize and develop R&I policies. These institutions are interrelated through different mechanisms.

Science, Industry and Technology Ministry (MoSIT) is responsible for the coordination of STI policies. The science, technology and innovation-related duties of the MoSIT are defined as the development, implementation and coordination of the S&T and innovation policies, and the promotion of the R&D and innovation projects, activities and investments.

At the political level, the Supreme Council of Science and Technology (BTYK) is the highest-ranking STI policy making body. It includes 20 permanent members chaired by the prime minister and other stakeholders. The BTYK determines, directs and coordinates research and innovation policies. The BTYK meetings take place twice a year with a pre-determined agenda. In total, over one hundred different actors from the governmental bodies, higher education and business enterprise sectors are represented in the meetings. The BTYK reports evaluate the ended or ongoing projects and present a roadmap to achieve predetermined targets of the BTYK or other governmental bodies. The Scientific and Technological Research Council of Turkey (TUBITAK), affiliated to MoSIT, acts as the secretariat of the BTYK.

The Ministry of Development (MoD) and the Higher Planning Council (YPK) are two other important actors in the design and implementation of science, technology and innovation policies. MoD provides R&D tax allowances and other related incentives. The Higher Planning Council (YPK), chaired by the prime minister, is the highest-level body for the preparation and implementation of the national development plans, which also covers S&T policy actions for Turkey. MoD is the secretary to the YPK. 26 Regional Development Agencies (RDAs) which are affiliated to MoD are established to encourage R&D and innovation on a regional scale.

The Ministry of National Education (MoNE) and the Higher Education Council (YOK) design and implement the education policies, and integrate them with the research

policies. Turkish Academy of Sciences (TUBA) determines and recommends scientific priority areas and proposes legislation to the government on issues related to scientists and researchers.

At the operational level, the leading actor in the implementation system is TUBITAK. TUBITAK takes the role in facilitating of experimentation and learning, knowledge development, knowledge diffusion, guidance of search and selection, market formation and development of mobilization of resources. TUBITAK provides grants for R&D, innovation, HRST, R&D and innovation networks and science and society. These grants aim to facilitate experiments and learning as well as development and mobilization of resources.

The Small and Medium-Sized Enterprises Development Organisation (KOSGEB) and the Technology Development Foundation of Turkey (TTGV) are other main bodies implementing industrial R&D support measures. Turkish Patent Institute (TPE) carries out the procedures related to industrial and intellectual property rights. Turkish Accreditation Agency (TURKAK) deals with the accreditation of organisations and laboratories. Turkish Statistical Institute (TURKSTAT) is the body responsible for providing statistical information related to R&D, innovation and industry, among others.

Scientific advice to the government is primarily provided by TUBITAK and TUBA. Both organisations are affiliated to MoSIT.

The detailed structure of STI system with their systemic functions is given in Figure 1.

Research funding

Although the proportion of R&D funded by business sector is significant, government continues to be the leading supporter of the Research and Innovation. The Scientific and Technological Research Council of Turkey (TUBITAK) is the leading agency for management, funding and conduct of research in Turkey. Moreover, since 2003 Turkey is associated to EU research framework programmes. Under the last program hold between 2007-2013, about 50 projects submitted approximately by 1000 participants from Turkey received almost €200m in EU funding⁴⁹.

Business enterprises sector is the leading sector with both its share in total r&D expenditure and among the R&D financers.

As indicated in 2014 SBA Factbook⁵⁰, Turkish economy is dominated by SMEs. SMEs provide over 75%

of jobs, accounts for 99.9% of all businesses and produce 53% of the domestic value added. In 2013,

108,930 new businesses were registered, but they are generally in wholesale and retail trade sectors. In 2013 and early 2014, Turkey implemented eight new policy measures addressing four of the ten Small Business Act principles on promoting entrepreneurship, improving access to finance and strengthening skills and innovation.

Although the budget allocated to R&I is increasing in Turkey, there is still no

⁴⁹ http://europa.eu/rapid/press-release_IP-14-631_en.htm

⁵⁰ http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/countries-sheets/2014/turkey_en.pdf

systematic mechanism aimed at evaluating the programs implemented, ex-ante, intermediary or ex-post. There are impact evaluation studies carried by academicians, researchers and public organizations and they are very limited in number.

There has been some recent developments on impact evaluation. The Division of Impact Evaluation in MoSIT was established in June, 2014⁵¹ with the goal of analyzing and increasing the efficiency of support programs. The main missions are collection of data and information required for the implementation of the impact analysis, for the organization of different kinds of meetings to increase capability of analysts and reporting activities. Ongoing impact assessment exercises concern Industrial Thesis Support Programme (SAN-TEZ), Techno-entrepreneurship Support Programme, R&D Centers established according to Law No 5746 on Supporting Research and Development Activities and Technology Development Zones established according to Law No 4691.

1.2.3 Research performers

The higher education system in Turkey is a centralized one. All HEI's are tied to Council of Higher Education (YOK) in accordance with the Higher Education Law (No. 2547). HEI's can be classified as Universities (State and Non-Profit Foundations), Institutes of High Technology and Post Secondary Vocational Schools⁵². By September 2014, there was a total of 190 HEIs in Turkey (YOK, 2014). 104 of them are State (Public) Universities and 72 were Non-Profit Foundation Universities with eight independent post-secondary vocational schools not attached to any university and six other higher education institutes⁵³. By October 2015, there is a total of 193 HEIs in Turkey (YOK, 2015). 109 of them are State (Public) Universities and 76 are Non-Profit Foundation Universities with eight independent post-secondary vocational schools not attached to any university (YOK, 2015)⁵⁴. As of 2014-2015 academic year there were approximately 6,062,886 million HEI students of which 0.97 % use distance education tools and the remaining part is face-to-face students. In total 420,324 thousand students enrolled in graduate studies. . In total 328,616 students are enrolled in graduate studies. Universities have six main units: Faculties are conducting higher education, scholarly research and publication. Graduate schools are concerned with graduate education, scholarly research and applications. Post-secondary School are concerned with providing instruction for a specific profession. Conservatories are institutions to train artists for music and the performing arts. Post-secondary Vocational Schools aim at training people in specific professions. Research and Application Centers are carrying out research and applied studies to meet the applied study needs of various areas.

⁵¹ will be discussed in more details in part 2.2.1

⁵² After July 2016, attempt of coup d'état, military and police academies are closed. Before that date, "Other Higher Education Institute (Military and Police Academies) were also included in the datasets. This may generate a confusion for the studies before and after coup d'état attempt.

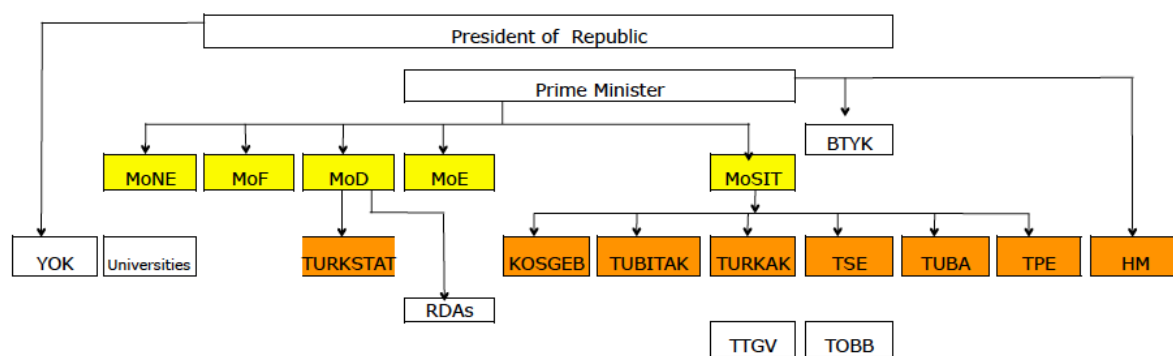
⁵³ These are the category of "Other Higher Education Institutes" which are deleted from also data sets after coup d'état attempt.

⁵⁴ http://www.yok.gov.tr/documents/10279/21040516/YOK_Stratejik_Plan_2016_2020_ed070616.pdf

State higher education institutions are funded by the government budget, based on a detailed itemizing of their expenditures, essentially prepared after consultations based on the previous year's allocations. Non-profit Foundation (private) Universities are funded by their foundations and students.

The main research performer in the public sector is Marmara Research Centre of TUBITAK together with 10 research centers/institutes of TUBITAK. It provides contractual research, testing, training, consultancy, analysis and certification services in its research centers, and operates a technopark. TUBITAK's institutes are the most active research organisations conducting research in their fields of specialisation. Some ministries like Ministry of Agriculture have their own research centers. For nuclear research activities, the Turkish Atomic Energy Authority is the main body both for strategy preparation and carrying out research activities. There are also R&D centers operating under universities and various ministries, such as the ministries of Energy and Natural Resources, and Food, Agriculture and Livestock.

Apart from public research agencies, there are private sector R&D centers founded according to law numbered 5746 which concerns the support of research and development activities. Figure 1 presents a snapshot of the research and innovation system of Turkey.



Research Institutes & Private Firms

BTYK: Supreme Council of Science and Technology
 MoF: Ministry of Finance
 MoSIT: Ministry of Science, Industry and Technology
 MoNE: Ministry of National Education
 MoD: Ministry of Development
 MoE: Ministry of Economy

TUBITAK: Scientific and Technological Research Council of Turkey
 KOSGEB: SME Development and Support Organisation
 HM: Undersecretariat of Treasury
 YOK: Higher Education Council
 TUBA: Turkish Academy of Sciences
 TSE: Turkish Standards Institute
 TURKSTAT: Turkish Statistical Institute
 RDAs: Regional Development Agencies
 TTGV: Technology Development Foundation of Turkey
 TURKAK: Turkish Accreditation Agency
 TPE: Turkish Patent Institute
 TOBB: Union of Chambers and Commodity Exchange of Turkey

Figure 1. Research and Innovation System of Turkey

2 Recent Developments in Research and Innovation Policy and systems

2.1 National R&I system

In Turkey, a major attempt for preparing a policy document is Vision 2023 document finalized in 2003⁵⁵.

The main objective of Vision 2023 is the creation of a welfare society in Turkey by means of mastering technology and science, by using efficiently existing technologies, by producing new ones and by translating new technologies into economic and social values⁵⁶. The "work packages" below were identified and implemented to contribute to the aforementioned objective: (i) identification of Turkey's position in the field of science and technology (ii) identification of worldwide long term trends in the field of science and technology (iii) determination of technological and scientific needs of Turkey in the light of Vision 2023 objectives (iv) identification of strategic technologies to attain these goals and finally (v) designing policies aimed at developing and/or acquiring these technologies. Based on these goals, a number of analyses were conducted at the sector level and policy proposals were delivered at an extremely detailed level, that is at the product and technology levels⁵⁷. Hence it is impossible to summarize or review policy recommendations here. Such an endeavor is not even necessary since the policy recommendations of the Vision 2023 project were not implemented by public institutions nor politically supported by the new government or by the new TUBITAK administration in the early 2000s. Therefore, the policy proposals that emerged of the Vision 2023 project, published at the end of November 2004, are by now not only obsolete but more importantly have never been implemented due to a lack of political willingness in the country.

The National Science, Technology and Innovation Strategy (2011-2016) document, called as NSTIS (UBTYS) 2011-2016, is still valid as the most important element of the national R&I strategy. The vision of the strategy is defined as *"to contribute to new knowledge and develop innovative technologies to improve the quality of life by transforming the former into products, processes, and services for the benefit of the country and humanity"*. The strategy outlines mission-oriented approaches in areas with strong RDI capacity, need-oriented approaches in areas with a demand for gaining acceleration, and bottom-up approaches including basic, applied and frontier research are identified. The strategic framework of National Science, Technology and Innovation Strategy (2011-2016) is comprised of three vertical axes and six horizontal axes, as shown in Figure 2. At the 25th meeting of BTYK, which was held on 15th January, 2013, health sector included within national prioritized areas. The action plan of the strategy is implemented by the decisions of BTYK in an integrated manner.

⁵⁵ <http://tubitak.gov.tr/en/about-us/policies/content-vision-2023>

⁵⁶ <https://www.tubitak.gov.tr/tr/kurumsal/politikalar/icerik-vizyon-2023>

⁵⁷ https://www.tubitak.gov.tr/tubitak_content_files/vizyon2023/Vizyon2023_Strateji_Belgesi.pdf

Figure 2 summarizes the strategic framework of UBTYS 2011-2016.

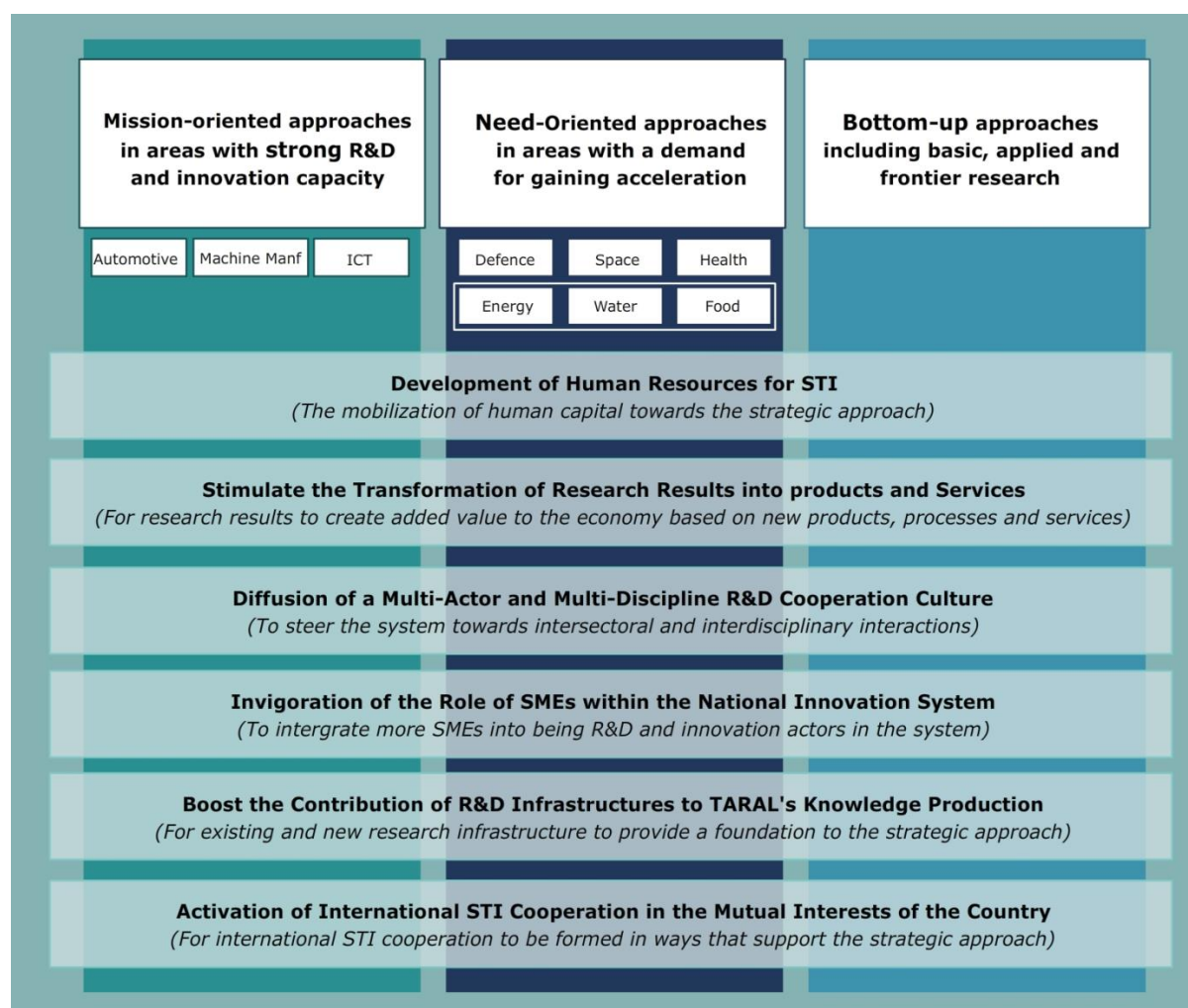


Figure 2. Strategic Framework of UBTYS 2011-2016.

Source: UBTYS 2011- 2016

In addition to UBTYS 2011-2016, various strategy documents are prepared:

- **Science and Technology Human Resources Strategy and Action Plan 2011-2016: The main targets of the strategy**, under the principles of good governance, include increasing the number of the R&D personnel and improving their sectoral and occupational distribution. This target involves policies aimed at directing young people toward R&D-intensive sectors, improving their career perspectives and income streams, devising programs to train people in the field of science and technology in accordance with the needs of the industry, increasing employment of technicians and at diffusing science and technology culture in the society.

- It was decided at the 21st meeting of the BTYK in June 2010 that R&D and innovation strategy documents would be prepared for three different domains (energy, water and food) under the supervision of TUBITAK, with the participation of experts from universities, public sector and industry. Strategy documents including the action plans had been prepared for each domain by December 2011. They are presented briefly below.

- **National Energy R&D and Innovation Strategy:** The vision of the strategy is to

establish global competitiveness through the production of knowledge and innovative outputs using resources efficiently and productively and considering quality of environment and life. The strategy further defines four strategic targets, namely mission-oriented prioritized R&D projects, capacity improvement, commercialization and collaboration.

- National Water R&D and Innovation Strategy: The vision of the strategy is to improve unique technologies and policies for the protection of water resources, productive and sustainable use of water resources, and the protection of access rights of all livelihoods to water. It also describes four strategic targets as the improvement of database infrastructure, mission-oriented prioritized R&D projects, capacity improvement, and socioeconomic and hydropolitic research.

- National Food R&D and Innovation Strategy: The vision of the strategy is to produce high value added, innovative and branding food products with environmental-friendly technologies. The strategy further develops six strategic targets, production of raw materials, industrial R&D and innovation activities, local capabilities and innovative products, food consumption and health, mission-oriented prioritized R&D projects, and sustainability and environment-friendly technologies.

In all of these documents, a systematic strategy development activities is achieved through the help of experts in line with national and international developments. However, it is not possible to note that these activities are preceded by any ex-ante policy appraisal. Moreover, the strategies include the elements of smart specialization at some extent though not completely. The elements of smart specialization are⁵⁸: (i) analysis of the regional context and potential for innovation (ii) set up of a sound and inclusive governance structure (iii) production of a shared vision about the future of the region (iv) selection of a limited number of priorities for regional development (v) establishment of suitable policy mixes, and (vi) integration of monitoring and evaluation mechanisms. In Turkey, some regional development agencies did carry out an analysis of the regional context and of the potential for innovation in a strategic framework and a limited number of priorities were selected. However, it is difficult to claim that the rest of the elements are taken into account. It can be perceived that all of these strategies are implemented and supported by policy tools such as regional mapping, compliance with the regional priorities, and regional support mechanisms through regional development agencies. The strategies have some cross-sections with EU priorities outlined by the Commission⁵⁹ in fields such as smart growth (targets pertaining R&D intensity and R&D environment) to the yet a complete harmony is difficult to be observed especially on inclusive growth and economic governance.

2.2 R&I policy initiatives

In Turkey, the main policy decisions on R&D/S&T/Research and Innovation are taken at the policy level at BTYK meetings. BTYK meetings are regularly held twice a year with the presidency of the prime minister except only one meeting was held in 2014. The last three years, most decisions aimed at strengthening the R&I capacity, in particular through measures on human capital but also on e- government related

⁵⁸ http://ec.europa.eu/regional_policy/sources/docgener/presenta/smart_specialisation/smart_ris3_2012.pdf

⁵⁹ http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/priorities/index_en.htm

issues; health became a priority area in S&T policies and the new decrees of the 26th BTYK meeting are targeted one specific sector: Energy. The decisions taken aim to promote the national energy resources.

In the 25th meeting of BTYK in January 2013⁶⁰, the following six new decisions mainly on the e- government infrastructure have been taken:

To monitor the highly-gifted individuals strategy of 2013-2017,

- To carry out studies on e-government management model,
- To complete the firm accreditation system for public procurement of e-government applications,
- To carry out studies on the establishment of National Database Centre,
- Public procurement of software needs of public institutions,
- To determine health as an S&T priority area.

In the 26th meeting of BTYK in June 2013⁶¹, the following seven new decrees were adopted due to its relevance to the theme discussed at the meeting. The focus of the meeting was on the enhancement of usage of national energy sources in energy mix and development of national energy technologies through public-private partnerships:

- Development of National Design and Manufacturing Capability for Thermal Power Plants (MİLTES)
- Development of Hydroelectric Energy Technologies (MİLHES)
- Development of Wind Energy Power Plant Technologies (MİLRES)
- Adaptation of Solar Energy Technologies (MİLGES)
- Development of National Design and Manufacturing Capability for Thermal Power Plant Flue Gas Treatment Technologies (MİLKAS)
- Development of Coal Gasification and Liquid Fuel Production Technologies
- Increasing Energy Efficiency

In the 27th meeting of BTYK convened in June 18 2014, six new decrees were outlined mainly on infrastructures and competitiveness:

- Designing support programmes for decreasing current account deficit and improving technological capabilities in health and biotechnology
- Improving support schemes for acquisition of global high-tech companies
- Constructing support programmes for the establishment of R&D labs of multinational companies in Turkey
- Establishment, improvement and support of research infrastructures in health and biotechnology
- Appointment of national coordinator institution point for Horizon 2020

⁶⁰<http://www.tubitak.gov.tr/tr/kurumsal/bilim-ve-teknoloji-yuksek-kurulu/toplantilar/icerik-bilim-ve-teknoloji-yuksek-kurulu-25toplantisi-15-ocak-2013>

⁶¹<http://www.tubitak.gov.tr/tr/kurumsal/bilim-ve-teknoloji-yuksek-kurulu/toplantilar/icerik-bilim-ve-teknoloji-yuksek-kurulu-25toplantisi-15-ocak-2013>

- Policies for the use of public R&D and innovation funds in 2014-2016

The 28th meeting took three new decisions in January 6, 2015:

- Commencing studies on the development of R&D strategies of universities
- Attempts toward increasing the quantity and quality of human capital holding Ph.D.
- Improvement and operation of international incubation center support

One of the strategic objectives of the National Science, Technology and Innovation Strategy (UBTYS) 2011-2016 aimed at addressing the lack of connection between Academia and Industry and valorizing the results of research to the market. To address this, the actions implementing the Strategy can be grouped in three domains:

(1) Actions with the purpose of promoting and enhancing entrepreneurial activities in Turkey include different support programs aiming at research and development activities and innovative ideas of entrepreneurs. They include, besides initial non-reimbursable cash support (subsidies), access to venture capital, business angels, mentoring (including formation of these mentors) and partly to marketing.

(2) Several mechanisms that facilitate the acquisition of intellectual/industrial property rights by researchers or their transfer from academia to industry, including cash support for national and international patent applications, establishment of Technology Transfer Offices at universities, prolongation in 2013 of the law establishing Technology Development Zones located on university campuses (and supposedly enhancing university-industry cooperation) from 2013 to 2023 and the reduction in 2014 from 50 to 30 of the minimum number of research personnel required to benefit from the R&D subsidies according to law 5746, which will attract more SMEs to apply to this program

(3) A reorganization of the public procurement system in a way to promote R&D and innovation is ongoing.

There are some common points between UBTYS 2011-2016 and the ERA priorities but not with all its pillars or at least not all to the same extent: smart growth (many elements of the Innovation Union, some of Digital agenda for Europe), sustainable growth (promotion of clean energy secondary with respect to the use of fuels with CO₂ emissions, support schemes to entrepreneurship) while the inclusive growth component is almost totally undealt with.

Two of the three recent academic research support programs launched by TUBITAK ARDEB (Research Support Program Directorate) examined below are good examples of the bottom-up approaches (including basic, applied and frontier research) of the strategic framework of the National Science, Technology and Innovation Strategy (2011-2016) while the third one is more in line with the one aiming to stimulate the transformation of research results into products and services⁶². Concerning the support provided by TUBITAK TEYDEB (Directorate for Technological and Innovation Support Programs) to industrial firms, note that all of the four recent support programs are related to the horizontal axis, i.e. transformation of the output of research into

⁶² Note that the first two programs are part of the three vertical axes that constitute Turkey's national STI strategy while the last program is one of the six horizontal axes.

products or services. Hence, it seems that after providing massive amounts of funding to R&D activities of firms, the focus has now shifted to (i) assisting them to access themselves this funding and to(ii) provide mentoring to SMEs and entrepreneurs possessing innovative ideas. These two issues are, indeed, estimated to be critical to commercialize their products on a reasonable scale.

Promotion of academic research

Furthermore, several new support programmes with the aim of promoting academic research have been launched by TUBITAK ARDEB during the period 2013-2015

Target based academic research have been promoted by a result-driven and targeted call based funding program of TÜBİTAK namely the Support Programme for Research, Technological Development and Innovation Projects in Priority Areas (TÜBİTAK-1003)⁶³. This program is directed towards researchers from both academia and private/public research institutes. Moreover, another program namely Public Institutions Research and Development Projects Support Programme (TÜBİTAK 1007 ⁶⁴) is revised to solve technological problems and satisfy the needs of public institutions by means of R&D projects. TÜBİTAK 1007 also promotes academic research through public- private large scale RDI consortiums

These programs are supported by ad-hoc governance mechanisms and technology foresight methods, including Delphi surveys. The results are used to prepare technology roadmaps in specific sub-topics of the priority areas. To date, 12 technology roadmaps have been prepared. These include "Energy Efficiency", "Mobile Communication Technologies", "Biomaterials", "Pharmaceuticals", "Vaccines", "Biomedical Equipment", "Medical Diagnostic Kits", "MEMS-NEMS Technologies" and "LED/OLED Display Technologies", "Lightweight Automotive Materials (Engineering Plastics and Metal Technologies)", "Embedded Systems in Automotive and Manufacturing Sectors" and "Control Systems and Industrial Automation in Manufacturing Sector". Besides technological areas which will have an impact on economic sectors, for the first time, the prioritization of areas in social sciences and humanities was realized as well (The concept mapping has yielded 6 main sub-areas; namely "Education", "Economic Development", "Urbanization", "Family Issues", "Culture" and "History"). Accordingly, calls are opened by TÜBİTAK in the topics that are prioritized by the sectoral stakeholders and technology foresight studies. The outcomes of the prioritization studies will continue to be fed into call-based programs.

The support program (TUBITAK 1004⁶⁵), called "Excellence Centers Support Programme" was launched in 2014. It aims developing the strategic collaboration between research infrastructures, public R&D organizations, private organizations, R&D centers and other organizations in order to make them specialized and be excellence centers.

The support program (TUBITAK 1071⁶⁶), called "Support Programme for Increasing the

⁶³<https://www.tubitak.gov.tr/tr/destekler/akademik/ulusal-destek-programlari/icerik-1003-oncelikli-alanlar-ar-ge-projeleri-destekleme-programi>

⁶⁴<https://www.tubitak.gov.tr/tr/destekler/akademik/ulusal-destek-programlari/icerik-1007-kamu-kurumlari-arastirma-ve-gelistirme-projelerini-dp>

⁶⁵http://www.tubitak.gov.tr/sites/default/files/1004_-_mukemmeliyet_merkezi_destek_programi-ilk_hali.pdf

⁶⁶http://www.tubitak.gov.tr/sites/default/files/256_sayili_bk_islenmis_hali-1071-1_0.pdf

Capacity to use International Research Funds and to Join International R&D Cooperations” was launched in 2015. The purpose of this program is to increase the capacity of researchers in Turkey on their applications to international support programmes and to boost the admission performance of national researchers on international bilateral and multilateral R&D opportunities.

Under TUBITAK 1004 and TUBITAK 1071 programmes, no calls were announced or no applications have been submitted yet.

The “/1” (TUBITAK 3001⁶⁷) was launched in 2013.

It aims at promoting R&D preparation and management culture. It concerns projects submitted by researchers without a previous TUBITAK project coordination experience and affiliated with universities, public institutions and those working in the business sector. Among the 360 (1,163) projects submitted in 2013 (end October 2014) 10 (401) were retained, with the rate of acceptance going from 2.7% to 34.4% over this period. By the end of October 2014, there were 396 projects running and a total allocated budget of 20 million TL.

Another support program (TUBITAK 1000⁶⁸) launched in 2013, is titled “Support Program aimed at developing the Research Potential of Universities”. Among its main aims are the promotion of research project culture at universities, production of high quality projects, creation of awareness about national/international project support mechanisms and finally, funding of those projects that might enhance the potential of universities to obtain national/international projects. Within the framework of this program, a call titled “increasing the capacity of universities to prepare projects funded by TUBITAK ARDEB” was launched. It aims to inform universities about TUBITAK ARDEB supports, enable them to benefit more thoroughly from these supports mechanisms, and to bring to daylight their potential to write high quality research projects. Among the 21 projects submitted by universities, 16 were subjected to peer evaluation and 8 were finally funded -these projects started on September 1st, 2014.

The last academic support program (TUBITAK 1005⁶⁹), called “National New Ideas and Products R&D Funding Program” was launched in 2013. It concerns funding those applied research and/or experimental development projects aimed at developing a new product/process/method/model of national or international scope and which might contribute to reducing dependency on foreign technologies and/or enhance national competitiveness. Among the 80 (273) projects submitted in

2013 (by the end of October 2014) 7 (14) were selected. 16 of them were running by the end of October 2014 and a total budget of 2 million TL has been allocated for these 16 projects.

⁶⁷ <https://www.tubitak.gov.tr/en/funds/academy/national-support-programmes/content-3001-starting-rd-projects-3funding-program>

⁶⁸ <http://www.tubitak.gov.tr/tr/destekler/akademik/ulusal-destek-programlari/icerik-1000-universitelerin-arastirma-ve-gelistirme-potansiyelinin-artirilmasina-yonelik-destek-programi>

⁶⁹ <https://www.tubitak.gov.tr/en/funds/academy/national-support-programmes/content-1005-national-new-ideas-and-products-rd-funding-program>

Promotion of industrial research

Besides funding provided to academic research, TUBITAK also provides direct support to industrial R&D through its Directorate for Technological and Innovation Support Programs (TEYDEB). Four new support measures have been launched by TUBITAK TEYDEB during the period 2013-2014.

The first one (TUBITAK 1515⁷⁰) is called "Frontier R&D Laboratory Support program" and started in the second half of 2014. This support is based on the consideration that after an initial phase of establishment, R&D laboratories reveal their real potential through long-term commitments, hence this support program aims to sustain the activities of R&D laboratories in the long-run. It also aims to enhance the quality of research conducted by Turkish scientists and establish Turkey as a global hub in certain scientific and technological fields. This grant-based program funds up to 75% of eligible R&D laboratory expenses

The second support program recently launched by TUBITAK TEYDEB (TUBITAK1601⁷¹) is called "Capacity Building for Innovation and Entrepreneurship Grant Programme" and was launched in June 2013.

The two main objectives of this program are to (i) develop further the national innovation and entrepreneurship system and (ii) to increase the efficiency as well as the effectiveness of public supports in the field of research and innovation in Turkey.

Within the framework of this program, and especially in accordance with its aim to promote mechanisms in order to develop national innovation and entrepreneurship system *the first call* "University Certification Program for Entrepreneurship " was launched in August". Its main objective is to consolidate the perception of entrepreneurship and innovativeness in Turkish universities and to commercialize successful business ideas in an early stage through a long-term entrepreneurship certificate program targeting university students - at the undergraduate and graduate levels - as well as faculty members. 14 among the 48 applications made by universities were selected and funded⁷². A new call with the same topic have been introduced in February 2015. 61 Universities applied for 2015 call, while 35 of them were eligible to be granted.

A *second call* launched in December 2013 was titled " SME Mentorship". The final beneficiaries of this call were SMEs, and the mentorship mechanism to be developed was expected to promote their R&D- and innovation-related activities. The first stage consisted of the development of the mentorship mechanism, which would be applied to a number of SMEs in the second stage. 30 companies applied for the call, and 6 of them were selected to perform first stage activities. At the end of the first stage these companies were evaluated as eligible to perform second stage activities.

A *third call* "Preparation and Capacity Building of Technology Transfer Offices (TTO)" have been introduced in July 2014 and aimed to support those universities where

⁷⁰<https://www.tubitak.gov.tr/en/funds/industry/national-support-programmes/content-1515-frontier-rd-laboratory-support-programme>

⁷¹<https://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1601-yenilik-girisimcilik-alanlarinda-kapasite-artirilmasina-yonelik-dp>

⁷² Another call in this field was launched in 2015.

technology transfer offices(TTOs) are at the establishment stage and do not benefit from sufficient infrastructure, experience, knowledge and human resources. The final objective is to prepare them to apply for the "Technology Transfer Offices Grant Programme" (TUBITAK 1513⁷³) with a more comprehensive and advanced support structure offered to universities. Applications were received from 20 TTOs and 9 of them have been granted.

A *fourth call* was launched in March 2015 and titled "Start-Up Accelerator Support". The final objective of this call is to support entrepreneurs in their efforts to transform innovation-focused business ideas into enterprises with a high potential of growth and employment creation. Through Start-Up Accelerator Support Call, 17 institutions have been granted for business idea validation and business plan creation services provided for BiGG-1512 applicants.

A *fifth call* launched in March 2015, is named "Mentor Training" aims to select entities which will educate those mentors registered in the mentor database of TUBITAK as well as expand this database.

Finally, a *sixth call*, "Enabling PhD Employment in Private Sector", was launched in July 2015. It aims to promote employment of doctorate holders in certain business firms by providing them grants in order to reduce the cost of hiring this highly-skilled personnel.

The third recent support program managed by TUBITAK TEYDEB (TUBITAK 1602⁷⁴), "Patent support Program", was launched in January 2014. Its objective is to increase the number of national and international patent applications made by residents in Turkey. Applications made to Turkish Patent Institute, European Patent Office, WIPO, Japan Patent Office and USPTO are all eligible for support. Grants are provided to cover all applications costs and later a monetary reward is provided if the patent is granted. 1,976 national and 339 international patent applications were made within the framework of the support program over the period January-October 2014, and a total amount of 7.1 million TL was provided as grant.

The fourth recent program by TUBITAK TEYDEB was launched in September 2013 (TUBITAK 1514⁷⁵) and called "Venture Capital Funding Program". Its objective is to provide grants to venture capital funds (VCFs) related to early stage equity investment in innovative SMEs. VCFs should assist these innovative SMEs with their technology-intensive R&D, production and commercialization activities. TUBITAK guarantees to provide as a grant at most 20% of the capital of the venture company to be founded by VCFs. The fund manager should contribute at least for 1% of the total capital of the company. TUBITAK's contribution to each venture company cannot exceed 15 million TL and will last for at most 12 years. The first five years of the support represent the investment phase and the remaining part is the exit period. This call targeted fund managers and prospective fund managers. 16 applications were received and it was decided to support two fund managers and six prospective funds managers.

⁷³ <http://tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1513-teknoloji-transfer-ofisleri-destekleme-programi>

⁷⁴ <https://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1602-tubitak-patent-destek-programi>

⁷⁵ <http://www.tubitak.gov.tr/sites/default/files/1514-2013-call.pdf>

Promotion of clusters

The first call of the Clustering Support Program⁷⁶ of the Ministry of Science, Industry and Technology (MoSIT) was launched in January 2014. Its aim is the development of inter-firm cooperation environment in order to enhance the clustering of firms operating in related activities. Among the expected outcomes are the improvement of the competitiveness and innovativeness of firms in Turkey, an increase in Turkey's share in world exports, a focus on manufacturing of hi-tech products and transition towards an industry structure respectful of environment and which uses high-skilled workforce. The target group of this support program consists of those legal entities (*interalia* universities, research institutions, chambers of industry) which are already at an advanced level of competition and sustainability. Funding is directed towards four types of activities aiming at (i) the development of coordination, awareness and/or of efficacy associated with clusters(ii) the development of conditions and markets for factors of production (iii) the actions leading to increase productivity and (iv) innovation. The time span of the support cannot exceed seven years. A second call was launched in July 2015.

Other developments

In 2013, the *Law No 4691 of Technology Development Zones* (TDZs) –published in the Official Gazette of July, 6th2001⁷⁷– on the basis of which entities operating therein with the purpose of conducting technological development activities can benefit from a number of tax incentives, was renewed until the year 2023. One important modification to the law was that firms could now carry out not only technological development activities but also manufacturing activities at a large scale in TDZs. This renewal and modification of the law occurred without any impact or evaluation analysis of the activities of TDZs over the period 2001-2013.

In the 28thmeeting of the Supreme Council of Science and Technology (BTYK) a decision was taken to develop and later implement an *International Incubation Center Support*⁷⁸. The objective of the support is double: (i) enhancing the brand recognition on export market soft technology-based products developed through domestic R&D activities and (ii) positioning of technology-intensive start-ups in advanced entrepreneurship ecosystems. The main implementing organizations of this support mechanism would be universities. The word “international” here means that these incubation centers would be established outside Turkey in technologically dynamic countries.

In 2013, the *Law No 5746 on Supporting Research and Development Activities*⁷⁹ was subjected to modifications. One major change relates to the required minimal number of research staff employed in R&D Centers in order to benefit from tax

⁷⁶ <https://kumelenme.sanayi.gov.tr/>

⁷⁷ <http://www.resmigazete.gov.tr/eskiler/2001/07/20010706.htm>

⁷⁸ http://www.tubitak.gov.tr/sites/default/files/70_yeni_2015_103.pdf

⁷⁹ <http://www.resmigazete.gov.tr/main.aspx?home=http://www.resmigazete.gov.tr/eskiler/2008/03/20080312.htm&main=http://www.resmigazete.gov.tr/eskiler/2008/03/20080312.htm>

incentives: this number went down from 50 to 30 without any sectoral consideration.

The *Division of Impact Evaluation (DIE)*, Directorate General of Science and Technology of MOSIT, was established by a law decree published in the Official Gazette on June, 28th2014⁸⁰. It is composed of three units in charge of data collection, analysis and evaluation and finally monitoring and reporting. The DIE has been conducting impact assessment studies on Industrial Thesis Support Program (SAN- TEZ), Techno-entrepreneurship Support Program, R&D Centers established according to Law No 5746 on Supporting Research and Development Activities and Technology Development Zones established according to Law No 4691. If these impact evaluation studies are conducted with the state of the art methodologies and if they are published, it could constitute a milestone for conducting similar exercises by the DIE for other R&D support programs that have been running for several years in Turkey, with obvious benefits for designing and applying STI policies in Turkey.

One of the main shortcomings of the public funding system target in enterprises in Turkey is its almost exclusive focus on research activities. The main public funding to business R&D is still provided by TUBITAK TEYDEB's Industry R&D Support Program⁸¹ since its creation in the mid-nineties. However, since the beginning of this decade its share in the total funding budget of TUBITAK TEYDEB has decreased on a sustained basis: in constant 2014 prices, this share was 76% in 2010, 69% in 2011, 68% in 2012, 57% in 2013 and 41% in October 2014⁸². The counterpart of this evolution has been a significant rise in the funding of programs devoted to the promotion of entrepreneurship activities, and especially its commercialization aspects (access to funding, incubators, patent applications, mentoring, technology transfer via technology transfer offices...). However, the funding of innovation and not solely R&D projects has been insufficient: The "R&D, Innovation and Industrial Application Support Program" of the Small and Medium-Sized Enterprises Development Organisation (KOSGEB), a mixture of soft loans and grants for the R&D projects of the SMEs, is extremely limited in volume.

As for the education aspect of STI policies, TUBITAK BİDEB (Scientist Support Directorate) has an elaborate support scheme in this domain that is implemented through scholarships for studies at the undergraduate and graduate levels, in Turkey as well as abroad⁸³. The target groups are Turkish and foreign students as well as Turkish researchers working abroad who desire to return to their homeland to continue their carrier. These programs aim at increasing the education level and quality of human capital, increase mobility of students, academicians and promote reverse brain drain by attracting Turkish and foreign researchers working abroad. The Higher Education Council offers similar scholarships at the graduate and post-graduate levels for Turkish student and academicians. It also has an exchange program for students and academicians in Turkey (FARABI exchange program).

In addition, The Regulation of Mevlana Exchange Programme was carried into effect as published on the Official Gazette dated 23/08/2011. Mevlana Exchange Program is a program which aims the exchange of students and academic staff between the Turkish

⁸⁰ <http://sagm.sanayi.gov.tr/Pages.aspx?pageID=908&lng=tr>

⁸¹ <http://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1501-tubitak-sanayi-ar-ge-projeleri-destekleme-programi>

⁸² http://www.tubitak.gov.tr/sites/default/files/btyk28_gelismeler.pdf

⁸³ <http://www.tubitak.gov.tr/sites/default/files/istatistiklerle-bideb-2003-2013.pdf>

higher education institutions and higher education institutions of all higher education institutions throughout the world regardless of geographical borders. Students from Turkish higher education institutions may study abroad for one or two terms and academic staff may lecture abroad from one week (minimum) to three months (maximum). Accordingly, students and academic staff from any country may benefit from this program being hosted by Turkish higher education institutions in order to study or lecture. It provides scholarship opportunities for both academic staff and students.⁸⁴

Within the framework of program of TUBITAK1601- Capacity Building for Innovation and Entrepreneurship Grant Programme (launched in 2013 "University Certification Program for Entrepreneurship" call have been introduced in August, 2013. In the framework of TUBITAK 5000 Open Course Material with Digital Content Support Program, open source e-books targeted at primary, secondary and undergraduate levels has been prepared.

Strengthening the knowledge-base and fundamental research

The main TUBITAK ARDEB funding offered for scientific research projects occur through the Scientific and Technological Research Projects Funding Program (TUBITAK 1001) and considerable resources have been channelled through this program for decades now. No impact evaluation, however, has been implemented to this date in order to assess its effectiveness. A much recent support program (TUBITAK1000⁸⁵) was launched in 2013 and titled "Support Program aimed at developing the Research Potential of Universities". Its main objective is to identify research areas where different universities are well positioned and, then, provide funds to implement projects in those same disciplines. A serious problem is the reduced demand for science disciplines' studies at the undergraduate level. The number of places available especially in university physics and chemistry departments for candidates attending the university entrance exam has not been fulfilled for sometimes. Besides a reduced interest for sciences disciplines on the part of youngsters, modifications brought to relevant legislations worsened employment opportunities for diploma holders of these science disciplines. Hence the reduced interest for these disciplines.

Research Infrastructures

The Ministry of Development allocated a total budget of 3 billion TL in constant 2014 prices⁸⁶ to fund research infrastructures (RIs) in state universities and public research institutions from 2003 to 2014. These RIs carry out their activities in technological priority areas in accordance with the National Development Plans and by the Supreme Council of Science and Technology.

There are two different types of RIs that benefit from public funding. The first category includes "Thematic Research Infrastructures". These are research laboratories located in relatively advanced universities and institutions which dispose

⁸⁴ <http://www.yok.gov.tr/web/mevlana/anasayfa>

⁸⁵ <http://www.tubitak.gov.tr/tr/destekler/akademik/ulusal-destek-programlari/icerik-1000-universitelerin-arastirma-ve-gelistirme-potansiyelinin-artirilmasina-yonelik-destek-programi>

⁸⁶ http://www.tubitak.gov.tr/sites/default/files/btyk28_gelismeler.pdf

of sufficient human resources. These RIs are expected to specialize in a (national) priority area and to conduct pioneering research at the national level. Their final objectives are to conduct advanced research at the national level, to increase the quantity and the quality of human resources and promote university-industry collaboration. Projects submitted exclusively by RIs from state universities and public research institutions were supported from 2003 to 2014 but from 2015 on, projects submitted by RIs from private universities are also taken into consideration for support. Funds were provided to 146 thematic RIs with the following distribution:

56 for public research organizations (of which 47 associated with TUBITAK), 78 for state universities and 12 for private universities⁸⁷. The second type of RI funded by the Ministry of Development is called "Central Research Laboratory". They are located in universities and research organizations with weak research infrastructure with the aim to carry out advanced research projects therein. Other objectives are to increase the attractiveness of newly established and young universities for highly qualified human resources, to promote research culture and develop industry-university collaboration through projects. These RIs are not under the control of a department, faculty or individual, and are managed transparently and open to all researchers. A total number of 95 Central Research Laboratories were funded by the Ministry of Development from 1997 to 2014⁸⁸.

In July, 10th2015, the Law No 6550 on Supporting Research Infrastructures⁸⁹ was published in the Official Gazette and in August, 28th2015 its implementing regulation⁹⁰ was published also therein. The new legislation has major implications as to the status, administration, management, funding, hiring policies, monitoring, evaluation and support provided to RIs. In a nutshell, this new law aims to contribute to the sustainability of RIs and to their more efficient functioning in Turkey. The problems encountered by RIs in state universities concern mainly⁹¹ (i) the duration of the funding provided by the Ministry of Development: this support is provided for a given time span and terminated thereafter, leading the RIs to search alternative sources of funding (ii) the low attractiveness of the RIs for researchers given the difficulty of having a tenure track when working as a researcher in RIs and low wages offered compared to job opportunities available in the private sector for high skilled researchers, and (iii) the difficulty of collaborating with the industry (or other entities) on a project basis as a source of funding given the public status of RIs in state universities and especially the system of revolving funds (an important part of revenues generated are transferred to the university and allocated to their expenses, and not to the RI generating them). All these endanger the sustainability of RIs and commercialization of their technologies.

The aforementioned new law is an attempt to remedy to these shortcomings on several fronts by enabling RIs to have a legal personality, by ensuring better management, by allowing employment of highly qualified and flexible work force, by leading to sustainable funding of their research activities and finally by promoting collaboration activities with external actors. Some of the significant measures of the

⁸⁷ http://www.tubitak.gov.tr/sites/default/files/btyk28_gelismeler.pdf

⁸⁸ http://www.tubitak.gov.tr/sites/default/files/btyk28_gelismeler.pdf

⁸⁹ <http://www.resmigazete.gov.tr/eskiler/2014/07/20140710-3.htm>

⁹⁰ <http://www.resmigazete.gov.tr/eskiler/2015/08/20150828M3-11.htm>

⁹¹ <http://stps.metu.edu.tr/sites/stps.metu.edu.tr/files/ARMER-RAPORU-13ekim-enson.pdf>

new law aim at:

- *Better management*: besides the board of management which will be formed of the representatives of business sector, universities and public institutions there will be an advisory council and a director – a professional manager whose remuneration is based on performance criteria.
- *Funding of research activities*: RIs will continue to benefit from public funding conditional on the monitoring and the evaluation of their research activities. They will also be entitled to tax incentives. However, they are also expected to generate their own revenues through projects submitted to national or international entities and carry out expenditures based on these funds
- *Hiring policy*: RIs will be able to hire researchers on the basis of the labor law (hence not constrained by the legislation regulating state universities), pay them a competitive salary and employ them on a flexible basis (part time). Foreign researchers will be hired as well.
- *Legal personality*: RI will have their own legal personality. As an entity, they can hire academicians coming from universities for a given time span (several years) on a contractual basis and hence pay them on a more competitive basis. The academician must leave the university and become a staff of the RI. At the end of the contract he/she can return to the university under certain conditions.
- *Collaboration*: RIs can be established jointly by universities and the business sector. They can be located in areas belonging to technology development zones, organized industrial zones, industrial districts, or to private initiatives. RIs can also create companies or become partners in existing ones. One major requirement is that they provide uninterrupted (24h/24h) service to all potential users without discrimination.

These are radical changes as far as the functioning of RI in state universities in Turkey are concerned. Their objective is to loosen above aforementioned restrictions which impact negatively on the sustainability of research activities in these entities. Possessing a legal personality and being able to attract high-qualified researchers have the potentiality to boost their performance and make them more sustainable at the same time. However, intrusion of business sector-related people at different levels of management, loosening of links with universities and generation of revenues through project-based activities or even through commercial activities are all developments that are sources of worry for the academic community: they fear that it might exert adverse effects on the nature of research activities conducted by RIs. Indeed, an increased involvement of business in the management and in the activities of RIs might end up with applied research and experimental development taking over fundamental research activities. This might jeopardize frontier research activities in Turkey given that university RIs (thematic or central research laboratories) are the main actors conducting this type of activity. In addition, it remains to be seen whether the important monitoring and evaluation exercises on which the sustainability of public funding depends are within the abilities of civil servants in Turkey. Indeed, such an exercise requires establishment of a number of performance criteria for RIs, their weighting, collection of data on these performance indicators, monitoring of performance of RIs based on these indicators and in certain cases establishment of control groups or counterfactuals in order to carry out an impact assessment analysis – a number of activities for which the number of civil

servants and/or time devoted by them to such activities might be insufficient, nor might they have the training necessary to conduct such exercises.

In conclusion, two points can be highlighted as a potential source of problems as far as RIs are concerned: (i) There is no national roadmap in accordance with ERA priority 2 (optimal transnational co-operation and competition to establish a common research agenda, improve interoperability of national programmes, and build effective pan-European research infrastructures.) and (ii) the weak transnational character of RIs operating in Turkey.

Evaluations, consultations, foresight exercises

The extremely limited number of impact evaluation studies carried by academicians^{92,93}, researchers⁹⁴ and public organizations – in the last case they are not published – point to the fact that a mechanism for the evaluation of R&D policies or a foresight exercises is not in place yet. Systematic evaluation of any kind -ex ante, intermediary or ex post- of support R&D programs policies has not been carried out yet in spite of the number, large scope and increasing budget allocated to direct and support programs aimed at increasing R&D and innovation activities in Turkey.

The Division of Impact Evaluation was established according to a law decree published in the Official Gazette on June, 28th 2014⁹⁵. This division is affiliated with the Directorate General of Science and Technology, itself part of the Ministry of Science, Industry and Technology. It is composed of three units in charge of data collection, analysis and evaluation and finally monitoring and reporting. Its main missions and duties are announced as (i) collection and conservation of data and information necessary to conduct studies on impact evaluation and performance indices (ii) organization of workshops, seminars and conferences aimed at learning and applying different techniques to be used in impact evaluation studies, (iii) conducting analyses in the framework of the impact evaluation exercises and construction of performance indices and (iv) communication of reports and documents on the activities of and studies realized by the Division to those organizations and institutions of interest. The main goals of the Division of Impact Evaluation aim at providing necessary information and knowledge to policy and decision makers in order to for them to (i) design efficient policies, (ii) determine whether or not support programs have the expected impact (iii) provide information necessary for the support programs to be developed and restructured. The Division of Impact Evaluation has been conducting impact assessment exercises on Industrial Thesis Support Programme (SAN-TEZ), Techno-entrepreneurship Support Programme, R&D Centers established according to Law No 5746 on Supporting Research and Development Activities and Technology Development Zones established according to Law No 4691. All these four support schemes are administered by the Ministry of Science, Industry and Technology. Besides, the Division is in charge of the following two ongoing projects: (i) evaluation of the support program to R&D Centers and (ii) impact of the entrepreneurship and

⁹² http://erf.org.eg/cms.php?id=publication_details&publication_id=1390

⁹³ <http://www.sciencedirect.com/science/journal/00487333/33/3>

⁹⁴ <http://www.case-research.eu/en/node/57595>

⁹⁵ <http://sagm.sanayi.gov.tr/Pages.aspx?pageID=908&lng=tr> and additional information provided by the Directorate General of Science and Technology, part of the Ministry of Science, Industry and Technology.

innovation support on the diffusion entrepreneurship culture in Turkey.

2.3 European Semester 2014 and 2015

2.4 National and Regional Research and Innovation Strategies on Smart Specialisation

Turkey is a unitary state where all policy fields, including research, are under the responsibility of the central government. The Turkish regional administrative hierarchy consists of provinces, counties, towns and villages which have all been equal in power and responsibility since 1925. In the 1950s Turkey was divided into seven geographical regions, where each one contained about 10 provinces and did not have any governance component. In 2002, in an attempt to harmonise with EU regulations, a new regional distribution was created according to the NUTS classification. According to the new classification, 81 provinces are grouped into 26 NUTS II clusters, provinces are considered as NUTS III level and 12 new adjacent province groups are labelled as NUTS I level. All regions in the country have the same status in terms of overall powers and responsibilities.

The government established 26 regional development agencies (RDAs) at NUTS II level in order to accelerate regional development through enhanced co-ordination and co-operation between all stakeholders. RDAs, which operate under the coordination of the MoD, design and implement programmes for stimulating R&D and innovation in their regions. The RDAs have also started to take initiatives to develop and implement regional innovation strategies by 2011. According to the law of RDAs which was enforced in 2006, the research/innovation-related duties of the agencies include (among others):

- Implementing and supporting research for the identification of the natural, economic and human resources, and increasing economic development and competitiveness of the region;
- Promoting the business and investment potential of the region at national and international levels in co-operation with the relevant institutions;
- Supporting small and medium sized enterprises and start-ups in terms of management, production, promotion, marketing, technology, finance, organisation and human resources training in co-operation with relevant institutions;
- Promoting activities in bilateral or multinational programmes in which Turkey participates in the region, and contributing to the efforts of project development in that respect.

There are, however, a number of Regional Development Agencies (RDAs) that prepare and implement innovation strategies at the regional level⁹⁶. By October 2015, six RDAs have already developed their regional innovation strategies and six others are in the preparation stage. It is worth noting that only the regional development strategy document prepared by the East Marmara Development Agency⁹⁷ provides a good

⁹⁶ http://www.oka.org.tr/Media/OKABIS_TURKCE.pdf,
http://www.insme.org/files/Izmir_Regional_Innovation_Strategy.pdf/at_download/file,
www.mersin.edu.tr/duyurular/dosya/ris.doc,

<http://www.dogumarmarabolgeplani.gov.tr/akillihtisaslasma.aspx>
⁹⁷ <http://www.dogumarmarabolgeplani.gov.tr/akillihtisaslasma.aspx>

example of a smart specialisation strategy while other RDAs focus on traditional regional innovation strategies⁹⁸. Regional development strategy documents by RDAs are prepared by these agencies by taking into account regional issues and priorities. The objectives and instruments used in these plan are not imposed by the Ministry of Development.

2.5 Main policy changes in the last five years

Main changes in 2011

The main changes in the research and innovation system in 2011 include the reorganisation of three key ministries:

- The Ministry of Science, Industry and Technology (MoSIT) replaced the former Ministry of Industry and Trade after the elections in June 2011.
 - The Ministry of Development (MoD) replaced the former State Planning Organisation and is responsible for providing advice to the government and preparing national plans, policies, strategies and programmes, and coordinating regional development agencies, among other things.
 - The Ministry of Development (MoD) replaced the former State Planning Organisation and is responsible for providing advice to the government and preparing national plans, policies, strategies and programmes, and coordinating regional development agencies, among other things.
 - The newly created Ministry of Economy (MoE) is responsible for developing and implementing of foreign trade and foreign direct investment policies, and investment incentives, among others.
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Main changes in 2012

Four new support programmes announced by TUBITAK in 2012.

The "Support Programme for Individual Entrepreneurs", a multistage programme aiming to support individual entrepreneurs to transform their technology and innovation focused business ideas into enterprises.

The "Support Programme for Research, Technological Development and Innovation Projects in Priority Areas" targets private sector companies.

The "Programme for Supporting R&D Projects in Priority Areas" was directed towards researchers from both academia and private/public research centers.

The "support Programme for Technology Transfer Offices" aims to commercialize knowledge and technology in universities, to establish collaboration between universities and the private sector and to produce knowledge and technology demanded by the industry.

Furthermore, TUBITAK revised its "Support Programme for Research and Development Projects of Public Institutions" in the same period (BTYK, 2013).

⁹⁸ <http://www.kalkinma.gov.tr/Pages/index.aspx#>

Main Changes in 2013

A number of new support measures aiming the promoting of academic research and industrial R&D have been launched by TUBITAK ARDEB TEYDEB in 2013.

The "Starting R&D Projects Funding Program" (TUBITAK 3001) aims at promoting R&D preparation and management culture and concerns projects submitted by researchers without previous TUBITAK project experience.

The "Support Program aimed at developing the Research Potential of Universities" (TUBITAK 1000) aims at the promotion of research project culture at universities, production of high quality projects, awareness rising about national/international project support mechanisms and funding of projects that might enhance the potential of universities in obtaining national/international projects.

The "National New Ideas and Products R&D Funding Program" (TUBITAK 1005) concerns funding those applied research or/and experimental development projects aimed at developing a new product/process/method/model of national or international scope and which might reduce dependency on foreign technologies and/or enhance national competitiveness.

The "Capacity Building for Innovation and Entrepreneurship Program" (TUBITAK 1601) aims at (i) developing further the national innovation and entrepreneurship system and (ii) increasing the efficiency and the effectiveness of public funding in the field of research and innovation in Turkey.

The "Venture Capital Funding Program" (TUBITAK 1514) aims at providing grants to venture capital funds (VCFs) for early stage equity investment in innovative SMEs.

The Law No 4691 of Technology Development Zones was renewed until the year 2023. Law No 5746 on Supporting Research and Development Activities was subject to modifications

Main changes in 2014

A number of measures with the aim of promoting academic research and industrial R&D have been launched by TUBITAK ARDEB and TEYDEB in 2014.

The "Frontier R&D Laboratory Support program" (TUBITAK 1515) aims to sustain the activities of R&D laboratories over the long-run, to enhance the quality of research conducted by Turkish scientists and to establish Turkey as a global hub in scientific and technological research.

A call made within the framework of TUBITAK 1601 program aimed to support those universities where technology transfer offices (TTOs) are at an early stage and do not enjoy sufficient infrastructure, experience, knowledge and human resources.

The objective of the "Patent support Program" TUBITAK TEYDEB (TUBITAK 1602) is to increase the number of national and international patent applications made by legal entities residing in Turkey.

The first call of the Clustering Support Program of the Ministry of Science, Industry and Technology (MoSIT) was launched and aims the development of interfirm cooperation environment in an effort to enhance the clustering of firms operating in related activities.

The Division of Impact Assessment affiliated with the Directorate General of Science and Technology of MoSIT was established and is composed of three units in charge of data collection, analysis and evaluation and finally monitoring and reporting.

Main changes in 2015

A call titled "Start-Up Accelerator Support" was made within the framework of TUBITAK 1601 program. The final objective of this multistage call is to support entrepreneurs in their efforts to transform innovation-focused business ideas into enterprises with a high potential of growth and employment creation. A call titled "Mentor Training" has been introduced within the framework of TUBITAK 1601 program with the aim to select organizations which will train mentors registered in the mentor database of TUBITAK as well as expand it.

3 Public and private funding of R&I and expenditure

3.1 Introduction

Total gross expenditure on R&D (GERD) of Turkey has increased more than 14 times from 2001 to 2014 on TL basis reaching €6,204.1m (TL17,598m) in 2014 according to the Turkish Statistical Institute (TURKSTAT, 2015)⁹⁹. In 2002-2014 period the rise in GERD in Euro terms is around 8.3 times. In the last three years (2012-2014) the rise in GERD is around 1.2 times in Euro terms. The rise in GERD per capita in Euro terms is 1.09 times in the same period. In 2014, GERD/GDP ratio for the first time has reached 1.01% in 2014¹⁰⁰. However, it is still far behind the EU15 average of 2.08. The ratio of BERD to GDP is far behind the EU average although it has been increasing in the last years. In Turkey, higher education institutions (HEIs) still have a considerable share in performing R&D: this share is 42.1% in Turkey while it amounts to 23.8% for the EU-28 countries¹⁰¹.

However the share of R&D performed by the business sector (45.1%) is for the first time higher than R&D performed by HEIs (%43,9) in 2012. This trend is persistent in 2013 and 2014. In EU-28 countries, 63% of the R&D is performed by business enterprise sector while proportion is 47.5% for Turkey. In 2014, 50.9% of R&D expenditures were financed by business enterprises, 26.3% by the government, 18.4% by higher education sector, 3,4% by other national sources and 1,1% by foreign funds.¹⁰²

For the GBAORD data, a slight decrease is observed in 2014 yet it is planned to be recovered in 2015¹⁰³. In 2008-2014 period GBAORD increased by 75% in Euro terms¹⁰⁴.

Turkey is supported by the Instrument for Pre-accession Assistance during years 2014-2020 (IPA II) in order to converge with the EU acquis on its path to accession. In this regard, under Competitiveness and Growth Pillar of IPA II, research and innovation is being supported under Competitiveness and Innovation Sector Operation Programme (CISOP). The overall objective of CISOP is to improve the business environment and innovation capacity. The expected results of CISOP are specified below:

- Improved functioning of the business sector, especially for SMEs and entrepreneurs;
- Improved access to finance for SMEs,
- Increased clustering, networking and SME internationalization,

Creation of scientific excellence and increased cooperation amongst public and private research and innovation bodies to increase economic development.

To this end, CISOP is composed of 3 actions namely; (1) private sector development, (2) science, technology and innovation and capacity building. The Science, Technology And Innovation Action aims to improve the functionality of the national innovation ecosystem by boosting industry engagement through public private partnerships (including but not

⁹⁹ €1=TL2.8365 (Central Bank of Turkey's banknote selling rate for 31.12.2014)

¹⁰⁰ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18661>

¹⁰¹ <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>

¹⁰² <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=18661>

¹⁰³ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18663>

¹⁰⁴ €1=TL2.1467 (Central Bank of Turkey's banknote selling rate for 31.12.2008) and €1=TL2.8365 (Central Bank of Turkey's banknote selling rate for 31.12.2014)

limited to university-industry collaboration) and improving SMEs' innovation management capacity. In this regard, research and development, technology transfer and commercialization activities are being supported under the Action. The total allocation for 2014-2020 is 4,453 M EUR and 344,4 M EUR is allocated to CISOP¹⁰⁵ (10% of total allocation).

Under the last EU Framework Programme (2007-13) over 1,000 participations from Turkish public and private institutions in some 950 projects received almost €200 million in EU funding¹⁰⁶. In Turkey 2015 (Progress) Report, the participation performance of Turkey in Horizon 2020 is evaluated as follows: "participation is good but there is room for improvement notably to increase participation in research and innovation actions on societal challenges, involve SMEs more systematically, and be successful in the first pillar of Horizon 2020 on Scientific Excellence."¹⁰⁷ (p. 75)

Turkey was associated to the Seventh EU Framework Programme (FP7). In total, Turkish entities obtained about €208.9m including EMPIR, COST and Eurostars. Compared to the 6th framework programme, this amounts to a 250% increase. For Horizon 2020, Turkey contributes to the programme with €83.7m. By the end of 2015, 197 projects were funded with a €71,3m share (including EMPIR, COST, Eurostars2) for Turkish partners¹⁰⁸.

In 2014, no significant change in the basic indicators for R&D investments have been observed. For 2015, it is expected to be stable with gradual changes mainly in upward direction. However, the political turmoil and resulting economic slowdown may have repercussions on the indicators in 2015. In the 27th and 28th meetings of BTYK, there are decisions (support programmes for the establishment of R&D labs of multinational companies in Turkey, improvement and operation of international incubation center support) to attract foreign R&D funds to Turkey. However, the impacts of these decisions will be felt with a considerable lag depending on their implementation.

Table 2 presents the basic indicators for R&D investment in Turkey compared to EU average.

¹⁰⁵ <http://abdigm.meb.gov.tr/projeler/ois/001.pdf>

¹⁰⁶ http://europa.eu/rapid/press-release_IP-14-631_en.htm

¹⁰⁷

http://ec.europa.eu/enlargement/pdf/key_documents/2015/20151110_report_turkey.pdf

¹⁰⁸ http://www.tubitak.gov.tr/sites/default/files/btyk28_gelismeler.pdf

Table 2. Basic indicators for R&D investments

| Indicator | 2011 | 2012 | 2013 | 2014 | 2015* | EU average |
|--|---------|---------|---------|---------|----------|------------|
| GERD (as % of GDP) | 0.86 | 0.92 | 0.95 | 1.01 | - | 1.94 |
| GERD (Euro per capita) | 65.46 | 63.3 | 68.84 | 79.85 | - | 558.4 |
| GBAORD (€m) | 1,756.9 | 1,795.4 | 1,880.7 | 1,810.7 | 1,887.83 | 92,094.21 |
| R&D funded by BES (% of GDP) ¹⁰⁶ | 0.39 | 0.43 | 0.46 | 0.51 | - | 1.1 |
| R&D funded by PNP (% of GDP) | 0.03 | 0.03 | 0.03 | 0.03 | - | 0.03 |
| R&D funded by government (% of GDP) | 0.25 | 0.26 | 0.25 | 0.27 | - | 0.66 |
| R&D funded by HEIs (% of GDP) | 0.18 | 0.19 | 0.19 | 0.19 | - | 0.02 |
| R&D funded from abroad(% of GDP) | 0.006 | 0.005 | 0.007 | 0.01 | - | 0.19 |
| R&D performed by HEIs (% of GERD) | 45.5 | 43.9 | 42.1 | 40.5 | - | 23.2 |
| R&D performed by government sector (% of GERD) | 11.3 | 11 | 10.4 | 9.7 | - | 12.6 |
| R&D performed by business sector (% of GERD) | 43.2 | 45.1 | 47.5 | 49.8 | - | 63.2 |

3.2 Smart fiscal consolidation

Following the 2001 economic crisis, the ratio of public sector borrowing requirement to GDP gradually has declined. In 2001, this rate was 12.1% while it decreased to 1% in 2014 and is planned to reach 0.4% in 2015¹⁰⁹. On the other hand, the borrowing requirement excluding interest rate payments is -2.18% in 2014 and borrowing requirement excluding privatization revenues and interest expenditures is -1.58%¹¹⁰. According to OECD Economic Survey on Turkey, the fiscal position of Turkey in 2014 is strong¹¹¹. According to medium term programme 2014-2016¹¹², *sustainability of*

¹⁰⁹ <http://www.bumko.gov.tr/TR,147/ekonomik-gostergeler.html>

¹¹⁰ <http://www.mod.gov.tr/Pages/PublicSectorStatics.aspx>

¹¹¹ <http://www.oecdilibrary.org/docserver/download/1014131e.pdf?expires=1440507007&id=id&accname=ocid43023559&checksum=4055840C126701AA49074BC04E62425C>

¹¹² <http://www.maliye.gov.tr/Documents/Medium%20Term%20Programme%202014-2016.pdf>

public finances will be pursued by keeping public sector borrowing requirement at reasonable levels, and achievements in public finances will be continued in future periods. The ratio of total tax revenues to GDP has been stable around 20% in the last four years¹¹³. The same is also valid for total revenues with approximately 40%¹¹⁴. Both rates are increasing gradually in the last decade. On the expenditure side, the share of total expenditures in GDP is around 39.83% in 2014 as compared to 36.75% in 2011. The ratio of public investment expenditures to GDP increased in 2013 and 2014 reached 4.20% and 4.06%, respectively.

In terms of smart fiscal consolidation, the medium term programme 2014-2016 states that *primary expenditures will be constrained by prioritization of expenditure programs and increasing efficiency. Fiscal space, which will be created through expenditure rationalization, will be used for infrastructure investments that will help bolstering economic growth, subsidies, and R&D supports*¹¹⁵. Therefore, Turkish government explicitly reveals her preference in favor of a smart fiscal consolidation. However, the recent GBAORD figures do not confirm this preference. Central government budget outlays on R&D decreased by 3.73% in 2014¹¹⁶. Central Government Budget expenditures on R&D accounted for 0.32% of GDP and 1.12% of the Central Government Budget expenditure in 2014, going back to 2012 levels (0.32% and 1.11%)¹¹⁷. These figures were, respectively, 0.37% and 1.28% in 2013. The largest share of Central Government Budget appropriations on R&D are directed to the socio-economic objective 'General advancement of knowledge: R&D financed from General University Funds (GUF)' with 40.2% for the year 2015. This share was 21.0% for 'Defense', 16.2% for 'Industrial production and technology' and 9.1% for 'General advancement of knowledge: R&D financed from other sources than GUF' respectively¹¹⁸.

3.3 Funding flows

3.3.1 Research funders

In Turkey, the main public bodies responsible for the allocation of research funds are Ministry of Science, Innovation and Technology (MoSIT) and the Scientific and Technological Research Council of Turkey (TUBITAK). In addition to these bodies, Ministry of Development (MoD), Ministry of Economy (MoE), Small and Medium-Sized Enterprises Development Organisation (KOSGEB), Ministry of Finance (MoF), Undersecretariat of Treasury, Ministry of Energy and Natural Resources, Ministry of Transport, Maritime Affairs and Communications, Ministry of Defence, Ministry of Food, Agriculture and Livestock, Ministry of Health, etc. all have direct and indirect mechanisms for allocating funds. One also observes new and, sometimes, innovative instruments for the public sector and academic R&D activities such as Support Programme of Public Institutes R&D Projects, Career Development Programme for young researchers, Support Programme to Increase the R&D Potential of Universities. Contribution of the public sector to R&D activities as a performer is another topic

¹¹³ <http://www.mod.gov.tr/Pages/PublicSectorStatics.aspx>

¹¹⁴ <http://www.mod.gov.tr/Pages/PublicSectorStatics.aspx>

¹¹⁵ <http://www.maliye.gov.tr/Documents/Medium%20Term%20Programme%202014-2016.pdf>

¹¹⁶ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18663>

¹¹⁷ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=16199>

¹¹⁸ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18663>

that has been debated for more than a decade. Government support mechanisms mostly stand on the direct R&D funding mainly via TUBITAK. In 2014, 80.5% of total R&D funding is the direct support¹¹⁹. Indirect R&D supports include tax incentives and exemptions based mainly on two laws: Law no 5746 enables organisations to fully discount their R&D expenditures from their corporate tax for the current year since 2008¹²⁰. The Law 4691 provides tax exemptions and reductions in social security contributions for firms operating in technology development zones. Before 2008, the discount rate was only 40%.

Among these funding organizations, TUBITAK has the widest range of supports available. TUBITAK supports can be grouped under six headings¹²¹:

1. Academic
2. Business/Industry
3. Public Institutions
4. Entrepreneurship
5. Scientific Events
6. Science and Society

In addition to these supports, TUBITAK provides undergraduate, graduate and postdoctoral scholarships to students and researchers. Moreover, TUBITAK has research institutes and centers in various natural and applied sciences and technologies. In this section, brief information on recent support programmes of TUBITAK will be provided. The supports provided by TUBITAK to academic projects reaches €122.9 m whereas for industry projects the total amount of funds is €220.5m October 2014¹²². TUBITAK also supports public institutions through "Support Programme for Research and Development Projects of Public Institutions". The programme accepts project applications to specific calls announced by TUBITAK taking into account public institutions' needs. To this end, TUBITAK has invited the public institutions to determine their priorities to be addressed by R&D projects. Over the 2005-2014 period, the total amount of funding is €115.6m for the concluded 114 projects¹²³. In addition to its support to public research institutions, TUBITAK has also developed science-business cooperation mechanisms (see chapter 5).

MoSIT as another principal public body allocating public funds has several programmes. One well-known programme in this context is the SAN-TEZ support since 2006. It aims to support graduate theses having the potential to generate high-value added and to contribute to the innovativeness, and competitiveness of the country. In 2013, 214 projects were supported with a budget of €14.44m. Until October 2014, 43 projects were supported with a budget of €5.77m. Over 2006-2013, chemistry, machinery and automotive are the top three sectors supported in the context of this programme¹²⁴. MoSIT has also Pre-Competitive Collaboration Support

¹¹⁹ <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18663>

¹²⁰ http://www.gib.gov.tr/fileadmin/user_upload/Tebliğler/5520/10.html

¹²¹ <http://www.tubitak.gov.tr/en>

¹²² <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹²³ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹²⁴ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

Program for strategic collaboration in inter and intra industry context. The program aims at strategic collaboration for collaborative R&D, product development, resource sharing, and distribution¹²⁵. Another support mechanism of MoSIT is the Techno-Initiative Capital Support Program and it was launched in 2009. Individuals with an R&D project as well as certain qualifications (students with a doctoral degree or master's degree, etc.) are provided with a grant up to 100.000 TL (€29,526) by public bodies and institutions¹²⁶. Among the projects submitted in the period between 2009-2014 1,034 projects are being supported by the end of October 2014. The number of projects supported only in 2014 is 270. Electronics and ICTs are the most important technology areas receiving supports¹²⁷. Another support mechanism is comprised of direct and indirect supports provided through Technology Development Zones¹²⁸. Until the end of October 2014, 59 Technology Development Zones were established and 41 of them are active by this date¹²⁹. Moreover, another mechanism administered by MoSIT, the establishment of R&D centers, started with the Law 5746: according to this law, institutions would fully discount their R&D expenditures from their corporate tax for the current year since 2008. In addition to this support, establishments receive other indirect supports such as income tax reductions employed in R&D centers, social security premium support and stamp tax exemption¹³⁰. This mechanism is generally directed towards large-scale establishments operating in Turkey. By the end of October 2014, 165 R&D centers are active with 20,786 R&D personnel¹³¹. Finally, a recent mechanism introduced by MoSIT in October 2013 is the Clustering Support Programme with the aim to boost the transformation of Turkish industry¹³². Two calls are published till October 2015, with the support of one cluster and the evaluation of the second call is still under review.

Technology Development Foundation of Turkey (TTGV) is a not-for-profit funder of technology projects. TTGV's new programme, 'Advanced Technology Project Supports (ITEP)' also reflects sectoral prioritization objectives of the new era¹³³. By the end of 2015, 9 ITEP projects were funded by TTGV towards certain infrastructures and firm level collaborations.

3.3.2 Funding sources and funding flows

The national public budget is the most important source of public funding flows. Figure 3 below shows the general trends of direct and indirect public funding between 2008-2015¹³⁴. In Euro terms, there is gradual upward trend in direct funding until 2013 and the figure is stabilized around €2000m. However, the trend has reversed over the last

¹²⁵ <https://biltek.sanayi.gov.tr/Sayfalar/rekabetOncesi.aspx>

¹²⁶ <https://biltek.sanayi.gov.tr/Sayfalar/en-us/tgsd.aspx>

¹²⁷ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹²⁸ <https://biltek.sanayi.gov.tr/Sayfalar/tgb.aspx>

¹²⁹ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹³⁰ <https://biltek.sanayi.gov.tr/Sayfalar/en-us/arge.aspx>

¹³¹ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹³² <https://kumelenme.sanayi.gov.tr/Hakkinda.aspx>

¹³³ <http://www.ttg.gov.tr/en/advanced-technology-projects-support-programme-itep>

¹³⁴ <http://tuik.gov.tr/PreHaberBultenleri.do?id=18663>

two years.¹³⁵ The Indirect funding follows a less stable trend. It decreases in 2013 and increases later on possibly because of

the establishment of new technology development zones and R&D centers. From the national budget in 2015 in terms of NABS classification, the highest share belongs to general university funds (40.2%), followed by defense (21%) and Industrial Production and Technology (16.2%).

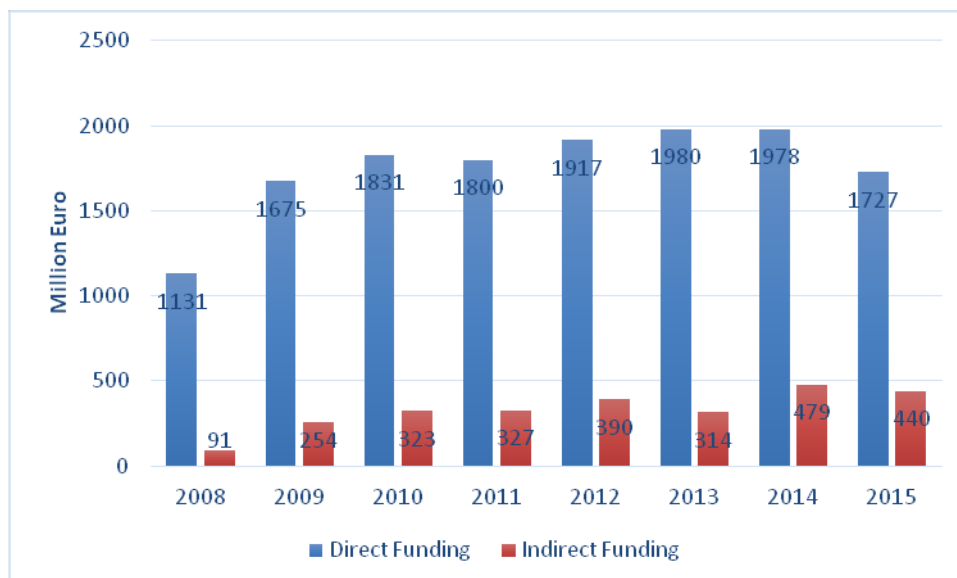


Figure 3. Central Government Budget Appropriations and Outlays on R&D and Indirect R&D Support, 2008-2015¹³⁶

The regional public budget for R&D in Turkey is mostly used by Regional Development Agencies. However, there is no official data on the share of R&D expenditures in the budget of these agencies. As noted in Section 3.1, Turkey uses IPA funds. Again for this case, there is no specific data on R&D funding from IPA funds. Turkey participated to EU 7th Framework programme for the period 2007-2013. Total contribution of Turkey to 7th FP is €356.5m (€261.1m from national funds and €95.3m EU grants). In this period, 1,206 Turkish partners engaged in 1012 projects. In total €208.9m from the programme was obtained (including EMPIR, COST, Eurostars). The highest share in terms of funding belongs to ICT calls (18.2%) followed by energy (11%) and health (8.3%). Turkey also decided to participate to H2020 with a total contribution of €107.1m (€83.7m from national funds and €23.4m EU grants) by the end of 2015. In the first two years of the Programme 197 projects involving Turkish partners received €71.3m (including EMPIR, COST, Eurostars2).

In 2013, the share of private sector in gross domestic R&D is 47.5% (€2,388.3m) while the shares of government sector and higher education sector are 10.4% (€524.3m) and 42.1% (€2,116.9m), respectively¹³⁷. In terms of the source of funds, 48.9% (€2,458.2m) of R&D expenditures are financed by the private sector in 2013.

¹³⁵ <https://muse.jhu.edu/article/614524/pdf>,
<http://www.tandfonline.com/doi/pdf/10.1080/23760818.2015.1099778?needAccess=true>

¹³⁶ http://www.tuik.gov.tr/PreTablo.do?alt_id=1082#

¹³⁷ <http://tuik.gov.tr/PreHaberBultenleri.do?id=16163>

The share of government sector is 26.6% (€1,335.5m) followed by higher education sector (20.4%- €1,027.8m), other national funds (3.3%- €166.2m) and funds from abroad (0.8%- €41.8m)¹³⁸. Unfortunately, the data on R&D related FDI is not available after 2007. According to a report on the analysis of R&D activities on foreign firms, the share of foreign firms in R&D expenditures of total manufacturing industry is around 36%¹³⁹.

3.4 Public funding for public R&I

3.4.1 Project vs. institutional allocation of public funding

In Turkey, institutional funding is a more dominant type of funding as compared to project funding. The institutional funding is generally directed towards the research infrastructures (public R&D labs, thematic research labs, and central research labs) funded by MoD. Each year MoD sends calls to universities and public institutions for their projects on research infrastructures for the prioritized areas defined in UBTYS 2011-2016¹⁴⁰. Each institution is allocated a prespecified budget for their projects. These institutions submit their projects to MoD. Following the negotiations, the supported projects for each institution are determined. Therefore, the selection of projects is done with a limited level of competition. This mechanism amounts partly to project funding and partly to institutional funding. The institutions either propose the establishment of new research infrastructures or the support of existing research infrastructures. The recent legislation (Law on the Support of Research Infrastructures) was promulgated in July 2014¹⁴¹. By the end of August 2015, the regulation for the implementation of this law was published¹⁴². This regulation outlines the issues for the accreditation of research infrastructures, their working and support principles. Together with this regulation, two additional regulations on the procurement and budget and accounting regulations of research infrastructures were also published¹⁴³. Following these legislative reforms, research infrastructures established and funded by MoD have obtained a legal status and their functioning is now well defined. According to performance criteria outlined by MoD, the research centers will receive institutional funding from MoD.

The competitive project funding of public institutions is realized through TUBITAK's "Support Programme for Research and Development Projects of Public Institutions". TUBITAK is informed about the needs of public institutions and publish annual calls for these needs. The purpose of the program is to address the R&D based problems or satisfy their R&D based requirements by means of result-oriented R&D projects and to

¹³⁸ <http://tuik.gov.tr/PreHaberBultenleri.do?id=16163>

¹³⁹ http://stps.metu.edu.tr/sites/stps.metu.edu.tr/files/YASED_part2.pdf

¹⁴⁰ <http://www3.kalkinma.gov.tr/Biltek.portal>

¹⁴¹ <http://www.resmigazete.gov.tr/eskiler/2014/07/20140710-3.htm>

¹⁴² <http://www.resmigazete.gov.tr/main.aspx?home=http://www.resmigazete.gov.tr/eskiler/2015/08/20150828.htm&main=http://www.resmigazete.gov.tr/eskiler/2015/08/20150828.htm>

¹⁴³ <http://www.resmigazete.gov.tr/main.aspx?home=http://www.resmigazete.gov.tr/eskiler/2015/08/20150828.htm&main=http://www.resmigazete.gov.tr/eskiler/2015/08/20150828.htm> and <http://www.resmigazete.gov.tr/main.aspx?home=http://www.resmigazete.gov.tr/eskiler/2015/08/20150828.htm&main=http://www.resmigazete.gov.tr/eskiler/2015/08/20150828.htm>

create awareness of R&D in public institutions. The projects proposed are assigned to one of the following units according to the field of the project, Public Research Grant Group (KAMAG) and Defence and Security Technologies Research Grant Group (SAVTAG). In this programme, public-private-university collaborations and commercialization of R&D activities in universities are also encouraged. Between 2005-2014, the programme received 1129 applications and 953 applications were rejected. Thus, the success rate is 15.6%. 114 projects were finalized in this period with a budget of TL320,8m (€115.6m)¹⁴⁴. After a major revision in 2012, the programme receives 68, 105 and 56 applications in 2012, 2013 and 2014 respectively. The total budget appropriations for the ongoing projects by October 2014 is €98.3m. In Turkey, there is no readily available data to compare the trends in institutional and project-based funding.

3.4.2 Institutional funding

In the period 2003-2014, MoD spent TL3b (€1.1b) for the support of research infrastructures in higher education and public institutions. In 2014, 56 (24 university, 32 public institutions) thematic research labs are supported with the budget of €50m¹⁴⁵. In addition to thematic research centers, MoD supports the establishment of central research labs in universities and research institutions lacking research infrastructures. In 2014, 13 central research labs are established. Thus, the total number of such labs reached 95¹⁴⁶. The projects are evaluated on the basis of defined priorities in UBTYS 2011-2016, physical and researchers' capacity of the institution, contribution of national R&D and innovative capacity and duplication of research infrastructures elsewhere. Therefore, it is possible to claim the existence of a limited competition and transparency. The mechanism is somewhat a hybrid one. It is sometimes in the form of block funding depending on predefined criteria and in some cases it is a project funding in a competitive manner. These predefined criteria can be grouped under some headings as sustainability of research infrastructures, the capability of the project team, the capacity and the capability of the institution, number of users, and impact. There is no data available on the evaluation mechanisms and success rates.

3.4.3 Project funding

“Support Programme for Research and Development Projects of Public Institutions” provides funds to projects up to 48 months with no budgetary limitations per project. The calls are generally in conformity with the priority areas specified in UBTYS 2011-2016¹⁴⁷. Therefore, it is possible to claim that the calls respond to societal challenges. In the first stage these projects are evaluated according to three criteria, namely relevance with the call, R&D content, and feasibility. At this stage projects are evaluated by a commission of national experts. Moreover, the applicants are also asked for a self-evaluation of institutional R&D capability during the submission of the

¹⁴⁴ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁴⁵ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁴⁶ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁴⁷ <http://www.tubitak.gov.tr/tr/destekler/kamu/ulusal-destek-programlari/icerik-1007-kamu-kurumlari-arastirma-ve-gelistirme-projelerini-dp>

project and site visits take place. The successful applicants are evaluated at the second stage according to four criteria (R&D content, methodology, feasibility, and budget) by a panel of experts. For the same call, the same panel of experts evaluates the projects. At the end of the panel evaluation, the decision for rejection or revision is given by TUBITAK. The next stage is revision evaluation for the revised projects. If a project passes the revision, a budget panel evaluates the project. The projects revised after the budget panel sign the contracts. No foreign evaluators are employed at any stage although it can be observed that the projects are evaluated on the basis of international standards. These projects also support doctoral students and post-docs through grants together with coordinators, researchers, and consultants. Moreover, TUBITAK has various programmes for researchers from the academia¹⁴⁸. These programmes provide a considerable amount of project funding for researchers. These programmes are discussed in detail in section 2.2.

3.4.4 Other allocation mechanism

In Turkey, the contract research for governmental organisations is generally carried out by private sector consultancy firms and universities through revolving funds. However, there is no data on R&D component of such contract research.

3.5 Public funding for private R&I

3.5.1 Direct funding for private R&I

In Turkey, R&D investments in firms are mainly stimulated through grants, soft loans and tax incentives. As stated in Section 3.3 and Chapter 5 below, TUBITAK has various programmes in order to encourage/stimulate research and innovation by the private sector. It is difficult to say already if effective, need time to assess.

These programmes are mainly coordinated by Technology and Innovation Funding Programmes Directorate (TEYDEB). The calls are often compatible with the priorities set by UBTYS 2011-2016. Peer review is used as an explicitly stated selection criteria such as public-private-university partnerships. However, still most of the support programs aim at R&D rather than innovation activities. The calls have significant R&D content rather than innovation. It is difficult to claim that there is well-targeted, clearly differentiated support schemes to finance innovation. As noted again in Section 3.3, there are recent programmes targeting specifically starts-ups and entrepreneurship, 3,200 projects are supported with a budget of 554 million TL (2016 fixed prices) in 2015 by TEYDEB¹⁴⁹. For 2013 and 2014, these figures are 2521 472 million tl (fixed 2016)) and 2859 531 million TL (2016 fixed prices), respectively. In this section, programmes with the most important budgets and the new programmes will be analyzed. A comprehensive list is presented in Annex 4.

The leading and the most longstanding grant programme aiming at the promotion of private R&D investments is the "Industrial R&D Projects Grant Programme"¹⁵⁰. Its

¹⁴⁸ <http://www.tubitak.gov.tr/tr/destekler/akademik/ulusal-destek-programlari>

¹⁴⁹ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksekkurulu-28-toplantisi-6-ocak-2015>

¹⁵⁰ <http://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1501-tubitak-sanayi-ar-ge-projeleri-destekleme-programi>

main aim is to encourage the private sector to invest in R&D and innovation by sharing the potential risk of being unsuccessful. It also aims to increase R&D awareness of the private sector. It supports grants up to 60% of the project budget. The programme received 872 project applications and 502 of them were funded with a budget of €46.8m corresponding to 41.4% of total TEYDEB supports¹⁵¹.

There is a clear shift from horizontal focus to sectoral focus in Turkish R&D and innovation policies. In Turkey, following the adoption of the National Science, Technology, and Innovation Strategy 2011-2016 by the Supreme Council for Science and Technology (SCST), there has been a paradigm shift towards a target and mission-oriented approach. Based on the Strategy, clear target figures have been set in terms of government R&D investments. Accordingly, nine priority areas have been adopted. These priorities include automotive, machinery-manufacturing, ICT, energy, water, food, health, space, and defence sectors. The sector-oriented standpoint was promoted by two result-driven and targeted call based funding programs of TÜBİTAK, which is the main funding authority for R&D in Turkey. These include the Support Programme for Research, Technological Development and Innovation Projects in Priority Areas (TÜBİTAK 1511) that targets private sector companies.

This program is supported by ad-hoc governance mechanisms and technology foresight methods, including Delphi surveys. The results are used to prepare technology roadmaps in specific sub-topics of the priority areas. To date, 12 technology roadmaps have been prepared. These include "Energy Efficiency", "Mobile Communication Technologies", "Biomaterials", "Pharmaceuticals", "Vaccines", "Biomedical Equipment", "Medical Diagnostic Kits", "MEMS-NEMS Technologies" and "LED/OLED Display Technologies", "Lightweight Automotive Materials (Engineering Plastics and Metal Technologies)", "Embedded Systems in Automotive and Manufacturing Sectors" and "Control Systems and Industrial Automation in Manufacturing Sector". Besides technological areas which will have an impact on economic sectors, for the first time, the prioritization of areas in social sciences and humanities was realized as well (The concept mapping has yielded 6 main sub-areas; namely "Education", "Economic Development", "Urbanization", "Family Issues", "Culture" and "History"). Accordingly, calls are opened by TÜBİTAK in the topics that are prioritized by the sectoral stakeholders and technology foresight studies. The outcomes of the prioritization studies will continue to be fed into call-based programs.

As discussed in Section 3.1, the most important support programme of TUBITAK toward entrepreneurship is "Support Programme for Multi-stage Entrepreneurship" with spending around €5m in 2014¹⁵². The name of the programme was changed to "Technoentrepreneurship Support Programme" in 2013. The name and the content of the programme changed further in 2015¹⁵³. Its new name is "Individual Young Entrepreneurship Programme" and it is still under the design and implementation

¹⁵¹ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁵² <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁵³ <http://biqq.tubitak.gov.tr/#biqq>

phases. This programme received 3,217 business idea and 1,317 of them passes to the second stage of. As a result of this programme, 111 new start-ups are established by the end of October 2014. The respective figures for 2012 and 2013 are 112 and 127.

“Support Programme for Technology Transfer Offices” aims to commercialize knowledge and technology in universities, to establish collaboration between universities and the private sector and to produce knowledge and technology demanded by the industry. This programme was announced in November 2012. 39 applications have been received to this call. 10 TTOs was supported in the first call. Further 10 TTOs were also supported in the second call by the end of 2013. In 2014, 5 TTOs were also supported¹⁵⁴. These 25 TTOs will be supported for at most 10 years with an annual budget of 1 million TL (€0.30m). By October 2014, the supported 20 TTOs received €6.4m¹⁵⁵.

“Patent Support Programme” provides grants for the total cost of national and international patent applications. It also provides prizes if the patents are received by the applicant. By the end of October 2014, the programme received 1,976 national and 339 international patent applications in 2014 with the budget of €2.56m.

“Capacity Building for Innovation and Entrepreneurship Grant Programme” established in July 2013 aims to support the efficient and productive use of public support in R&D and innovation and to improve national innovation and entrepreneurship ecosystem¹⁵⁶. In this context, the calls are opened for training, clustering, collaboration networks, brokerage and venture capital activities. The first call was opened on the establishment and implementation of entrepreneurship certificate programmes in universities in August 2013. 48 universities applied to this call and 14 of them were supported. The second call in 2013 was on the development and implementation of mentorship mechanism to enhance the R&D and innovation capacity of private sector firms. The call received 30 applications from the firms and 6 of them were supported. In 2014, a call is open for TTOs at the establishment and initial stages. The calls aims to improve capacity and capability of new TTOs which are not supported by the Support Programme for Technology Transfer Offices”. 20 universities applied to this call and 9 of them were supported¹⁵⁷. The final call aims to encourage hiring of of Ph.D. holders in the private sector. The final call of this scheme is announced in July 2015 and closed in the mid-August 2015. The theme of the call is the support of the employment of Ph.D. holders in the private sector¹⁵⁸.

“Venture Capital Funding Programme” was launched in August 2013. This program aims to provide grants to venture capital funds focusing on early (seed and startup) stage equity investments in innovative SMEs which have the potential to develop

¹⁵⁴ <http://www.tubitak.gov.tr/tr/duyuru/1513-ve-1601-tto-2014-cagri-sonuclari-aciklandi>

¹⁵⁵ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

¹⁵⁶ <http://tubitak.gov.tr/en/funds/industry/national-support-programmes/content-1601-capacity-building-for-innovation-and-entrepreneurship-grant-programme>

¹⁵⁷ <http://www.tubitak.gov.tr/tr/duyuru/1513-ve-1601-tto-2014-cagri-sonuclari-aciklandi>

¹⁵⁸ <http://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/cagri-ozel-sektorde-doktorali-personel-istihdaminin-desteklenmesi>

innovative products, services and/or production processes. TUBITAK contributes to venture capital funds with a grant up to TL15m (€4.4m). TÜBİTAK grants will not be higher than 20 percent of the fund's total size. Private Investors will provide at least 79 percent of the fund's total size and fund manager will provide at least 1 percent of the fund's total size. The minimum fund size is TL20m (€4.4m)¹⁵⁹. In 2013 call, TUBITAK received 16 applications and 2 fund managers and 6 candidate fund managers were supported.

A new programme that started in the second half of 2014 is "Frontier R&D Laboratory Support Programme" which applies an integrated perspective that extends beyond a consideration of the initial, establishment phase of the R&D laboratory. It offers an entirely grant-based financial model to cover of the operating expenses of the R&D laboratory in Turkey with up to TL10m (€2.9m) for each year for a duration of at most 10 years¹⁶⁰. The coverage of the grant support consists of personnel costs, general operating costs, and consultancy fees. Prior to the grant support, TUBITAK did further provide the company with pre-application support to familiarize it with the R&D capacities in the ecosystem of Turkey. Such a consultancy will allow the integration of the company to the ecosystem. This mechanism is in conformity with the decision taken in 27th of BTYK meeting aimed at "constructing support programmes for the establishment of R&D labs of multinational companies in Turkey"¹⁶¹.

As discussed in Section 3.3.1, MoSIT is another principal public body allocating public funds. Since the support programmes of MoSIT is discussed in detail in Section 3.3.1, a very brief account of these programmes will be given here. MoSIT general supports are based on two legislations providing indirect fiscal incentives, namely the 'Law on Technology Development Zones' and the 'Law on Supporting Research and Development activities' to stimulate R&D and innovation activities¹⁶². These will again be discussed in Section 3.5.2.

The Small and Medium-Sized Enterprises Development Organisation (KOSGEB) is an affiliated agency of MoSIT implementing centrally designed R&D programmes through its regional branches. KOSGEB provides a mixture of soft loans and grants for the R&D projects of the small and medium-sized enterprises under its "R&D, Innovation and Industrial Application Support Programme". KOSGEB encourages the creation of techno-entrepreneurs through its "R&D, Innovation and Industrial Application Support Programme". In 2014, KOSGEB contributed to the employment of 1,428 R&D personnel with the support of €3.6m through this programme¹⁶³. Another support

¹⁵⁹ <http://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1514-girisim-sermayesi->

¹⁶⁰ <http://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1515-oncul-ar-ge-laboratuvarlari-destekleme-programi>,

¹⁶¹ <http://www.tubitak.gov.tr/tr/kurumsal/bilim-ve-teknoloji-yuksek-kurulu/toplantilar/icerik-bilim-ve-teknoloji-yuksek-kurulu-27-toplantisi-18-haziran-2014>

¹⁶² Namely Laws 4691 and 5746, <http://www.resmigazete.gov.tr/eskiler/2014/03/20140312-2.htm> and <http://www.resmigazete.gov.tr/eskiler/2008/03/20080312-2.htm>

¹⁶³

measure of KOSGEB is incubation centers called TEKMER. Through TEKMERs university-industry-public collaboration is enhanced. KOSGEB supports 43 TEKMERs in 27 different provinces. The programme provides incentives to 1,078 firms with a sum of €19.9m. KOSGEB provides grants to firms through its "R&D and Innovation Support Programme"¹⁶⁴. In 2014, 797 firms are supported with €9.9m. 307 firms obtained grants from KOSGEB through "Industrial Application Support Programme" with a total budget of €10.1m in 2014.

There exists an approach for innovative public procurement and some measures to stimulate public procurement of innovative solutions to improve public services, including through dedicated budgets and joint procurement. The 23rd, 24th and 25th BTYK meetings took decisions towards enhancing public procurement. The decision aims to improve public procurement and public right of use in such a way to foster innovation, localisation and technology transfer, to improve public procurements to support innovativeness, and to complete the firm accreditation system for public procurement of e- government applications and public procurement of software needs of public institutions¹⁶⁵. Thus, the BTYK decisions especially support public procurement in the ICT area. The necessary regulation on the amendment of the Law on Public Procurement is rearranged for the public procurement of e- government. In 2014, new legal amendments took place¹⁶⁶. The software needs of all the public institutions are gathered. The necessary procedure and models are developed for joint procurement of software for public institutions not only to avoid the duplicative purchases but also to use the advantage of low-cost buying. The BTYK decision aiming at improving public procurement and public right of use in such a way to foster innovation, localisation and technology transfer is an opportunity. In the last meeting of BTYK, the progress report of the decisions is revealed¹⁶⁷. TUBITAK started a project supporting electrical vehicle production with 100% R&D subsidy in February 2013¹⁶⁸. MoSIT affirms it will purchase 200 manufactured vehicles over a period of 5 years. It is also planned to encourage public procurement of electrical vehicle in the long run. The BTYK decision aiming to promote public procurement for innovation is an opportunity to increase the demand for innovations and the diffusion of innovations. However, the terms of public procurement focus extensively on research while innovation is relatively little tackled, they generally do not have a competitive basis especially in the defense industry. There is a need to develop and implement demand-

<http://cdd.kosgeb.gov.tr/fb41e5fb02b84c54b4b29815a119535fd43529340beb45d3ae7621830123d9a2abf06c5643454f1db1ac5242f51055a51d07be62071f4ef98ae865e9906fb717e78ac0df2a1a4b84bc4f934c8dbac20f/file.axd>

¹⁶⁴

<http://cdd.kosgeb.gov.tr/fb41e5fb02b84c54b4b29815a119535fd43529340beb45d3ae7621830123d9a2abf06c5643454f1db1ac5242f51055a51d07be62071f4ef98ae865e9906fb717e78ac0df2a1a4b84bc4f934c8dbac20f/file.axd>

¹⁶⁵ http://www.tubitak.gov.tr/sites/default/files/btyk26_gelismelere_iliskin_degerlendirmeler_0.pdf

¹⁶⁶ <http://www.resmigazete.gov.tr/eskiler/2015/02/20150215-1.htm>

¹⁶⁷ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksekkurulu-28-toplantisi-6-ocak-2015>

¹⁶⁸ <http://www.tubitak.gov.tr/tr/haber/tubitak-elektrikli-arac-uretimine-yuzde-100-ar-ge-destegi-verecek>

side innovation policies and policy measures in a more systematic manner¹⁶⁹. In sum, there is a need for innovation-oriented procurement policy. Apart from defence industry and partly ICT needs of government, there is no systematic innovation-oriented procurement policy in Turkey.

3.5.2 Indirect financial support for private R&I

Indirect R&D supports cover the tax incentives and exemptions based on several laws¹⁷⁰. For instance according to Law 5746, institutions can fully discount their R&D expenditures from their corporate tax for the current year since 2008¹⁷¹. Before 2008, the discount rate was only 40%. As discussed in Section 3.3.2, the Indirect financial support from the budget follows a less stable trend compared to direct funding. It decreases in 2013 and increases later on (see Figure 3) possibly because of the establishment of new technology development zones and R&D centers. The total value of indirect financial support is expected to be €440m in 2015. The previous figures in 2013 and 2014 are €314m and €479m respectively. The ratio of indirect funding to direct funding has been increasing since 2013. This figure was 15.8% in 2013, rose to 24.2% in 2014 and 25% in 2015¹⁷². Unfortunately, from the existing GBAORD data, it is not possible to differentiate direct funding of business R&D and direct funding of public sector R&D. One approximate way may be to exclude general university funds. In this case, the ratio of indirect funding to direct funding reaches 42.6%. All the indirect R&D supports provided by TUIK covers tax exemptions and reductions in the context of laws 193 (Income Tax Law), 5520 (Corporate Tax Law), 4691 (Technology Development Zones Law) and 5746 (R&D Activities Support Law). These measures contribute not only to physical capital but also to the human capital base of the country. In these laws, government indirect R&D funding includes tax incentives such as R&D tax credits, R&D allowances, reductions in R&D workers' wage taxes and social security contributions, and accelerated depreciation of R&D capital. Therefore, all indirect supports from GBAORD are related with the private financing of R&D. One of the most important problems in Technology Development Zones is that there are very limited global R&I investments, a barrier for Turkish firms to articulate with the global supply and value chains and learning opportunities. No published evaluation of indirect R&D funding is available. MoSIT's Impact Assessment Directorate has started to impact assessment of R&D centers and technology development zones in 2015.

¹⁶⁹ <http://www.sanayisurasi.gov.tr/pdfs/kalkinma-temelli-kamu-alimi-politikolari-politika-deneyimleri-ve-literaturden-secilmis-ornekler.pdf>

¹⁷⁰ Namely Law 193 (<http://www.mevzuat.gov.tr/MevzuatMetin/1.4.193.pdf>), Law 5520 (<http://www.mevzuat.gov.tr/MevzuatMetin/1.5.5520.doc>), Law 4691 (<http://www.mevzuat.gov.tr/MevzuatMetin/1.5.4691.pdf>), 5746 (<http://www.mevzuat.gov.tr/MevzuatMetin/1.5.5746.pdf>).

¹⁷¹ http://www.gib.gov.tr/fileadmin/user_upload/Tebliğler/5520/10.html

¹⁷² <http://tuik.gov.tr/PreHaberBultenleri.do?id=18663>, values for 2015 are estimated figures.

3.6 Assessment

In Turkey, there is an increased commitment among the policy-makers to develop and implement strategic, coherent and integrated policy framework, but there is a need to do it in a clear and comprehensive way. The strategies aim at disseminating culture of multilateral and multidisciplinary R&D and innovation cooperation, stimulating sectoral and regional R&D and innovations dynamics, encouraging SMEs to become stronger actors within the national innovation system, and enhancing the contribution of research infrastructures to knowledge creation capacity of the Turkish Research Area. Mission-oriented approaches in areas with strong RDI capacity, need-oriented approaches in areas with a demand for gaining acceleration, and bottom-up approaches including basic, applied and frontier research are identified under UBTYS 2011-2016, and the strategic framework has been set. However, the decision-making and funding bodies are sometimes lacking proactive attitude towards grand societal challenges like demographic change and wellbeing, secure, clean and efficient energy, climate action, environment, resource efficiency and raw materials as stated by Europe 2020 strategy¹⁷³. There is a need to develop innovative financing solutions (e.g. public-private partnerships, equity finance, etc.) and to stimulate private finance (such as angel investments and venture capital) for R&D and innovation. These issues are still challenging problems of the public R&D funding system. It is possible to observe a multi-annual strategy defining national priorities. Furthermore, there exist national targets for monitoring policy implementation and public R&D funding system. In addition, although the establishment of evaluation office at MoSIT is a step forward, another concern is an urgent need to develop an evaluation culture and establish an effective mechanism for systematic evaluation of the public R&D funding system, policies and policy measures on the basis of internationally recognised criteria. In the absence of an efficient evaluation system, it remains unclear whether research funding mechanisms end up with optimal or sub-optimal results as evident from the “Doing Business Index” presented in Section 5.1. Another measure to be introduced is the development of efficient standard-setting system supporting innovative products and services.

There is a need to enrich the policy mix with instruments to support the commercialisation of innovative ideas such as innovation/knowledge clusters, creative clusters, knowledge transfer platforms, and voucher systems, notably for SMEs. There exist procedures for the selection of projects on the basis of quality and expected results and subject to external peer review. Allocation of high share of research funding on a competitive basis has been strengthened over the last years. Higher importance is attached to the researchers’ mobility at national, sectoral and international levels. However, the system needs to create the legal basis, and design and implement policy measures specifically targeting the stimulation of mobility of researchers and innovators between public and private institutions.

The recent economic and political instability in Turkey and around the country (civil war in Syria, Iraq, illegal migration, political unrest in Caucasus etc.) may have repercussions on STI policy in terms of possible budgetary cuts and worsened

¹⁷³ <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges>

performance in the near future. Moreover, there are problems regarding predictable budgetary framework. Sometimes the pressures of interest groups are heavily represented in decision-making process rather than social needs¹⁷⁴.The coordination problems among different ministries in terms of the implementation STI policies and creation of similar support mechanisms may create barriers for improved performance. In sum, there are significant attempts to develop well targeted, clearly differentiated, and easy to access support schemes in support of business research and innovation, but the mission-oriented calls for support in priority areas should be enhanced. The BTYK decisions aiming to secure integrity, coherence and target-oriented approach in R&D, innovation and entrepreneurship support mechanisms is an opportunity. Moreover, support measures specific to SMEs are present in many areas together with support measures and increasing awareness on the need for specific support to young innovative companies. Transparency in funding should be enhanced. There is still a need to enrich the policy mix with the support schemes tailored to the needs of companies, particularly SMEs. In addition to financial supports, there should be supports directed towards knowledge-intensive business services around the agglomerations of SMEs and start-ups. There exist measures to stimulate public procurement of innovative solutions to improve public services, including through dedicated budgets and joint procurement. The recent BTYK decisions especially support public procurement in ICT area. The BTYK decision aiming at improving public procurement and public right of use in such a way to foster innovation, localisation and technology transfer is also an opportunity yet the development of policies and incentives to stimulate innovation in the public sector and in the delivery of public services is needed.

¹⁷⁴ http://www.afroeurasianstudies.net/dosyalar/site_resim/veri/9160762.pdf

4 Quality of science base and priorities of the European Research Area

4.1 Quality of the science base

Table 3. The Quality of Science Base

| Indicator | Turkey (Year) | EU-28 |
|---|--|-------------|
| Number of publications per thousand population | 0.343 (2013) 0.351 (2014) | |
| Share of international co-publications | 19.1% (2013) | |
| Number of international publications per thousand population | Full- 0.09 (2013) | |
| International scientific co-publication per thousand population | 0.082 (2015) | 0.459 |
| Percentage of publications in the top 10% most cited publications | Full- 6.38 (2000-2013) Frac- 5.56 (2000-2013) 4.8 (2015) | 10.5 (2015) |
| Share of public-private co-publications | 0.4% (2011-2013) | |
| Public-private co-publication per thousand population | 0.014(2015) | 0.339(2015) |

Source: JRC IPTS RIO elaboration on Scopus data collected by Sciencematrix in a study for the European Commission DG RTD (Campbell, 2013). The share of public-private co-publications is derived from the Scival platform and is also based on Scopus data¹⁷⁵. The data on public-private co-publications is not fully compatible with the data included in the IUS, due to differences in the methodology and the publication database adopted.

Among 34 countries' data on quality of the science base provided by JRC IPTS, Turkey has the lowest figures and shares except for percentage of publications in the 10% most cited publications

Based on the information in European Innovation Scoreboard 2016, for the number of new doctorate graduates per thousand population between 25-34 ages, Turkey has the lowest figure among 36 countries with 0.4 while the EU average is given by 1.8¹⁷⁶. For international scientific co-publication per million population, Turkey has one of the lowest figures with 81.8, following Ukraine. Turkey also in the lowest proportion in scientific publications in the top 10% most cited publications. Figures show that

¹⁷⁵ Scival © 2016 Elsevier B.V. All rights reserved. SciVal ® is a registered trademark of Reed Elsevier Properties S.A., used under license.

¹⁷⁶ European Innovation Scoreboard, 2016.

<http://ec.europa.eu/DocsRoom/documents/17822>

Turkey has weak public-private linkages, and the collaboration between business sector researchers and public sector researchers is insufficient. Moreover, the employment in knowledge-intensive activities just 5.7% of the total employment, whereas it is 13.9% for EU-28.

4.2 Optimal transnational co-operation and competition

4.2.1 Joint programming, research agendas and calls

Investment in research and innovation from the EU budget between 2007 and 2013 has greatly improved scientific excellence in Europe and strengthened its competitiveness by improving industry's capacity to innovate¹⁷⁷. Turkey participated to 7th Framework Programme (FP7) in 2007¹⁷⁸. One of the main channels of transnational co-operation and competition, the FP7 of EU, has ended by the end of 2013. Under this programme 1,004 projects have been signed with participation of 1204 partners under 286 coordinators¹⁷⁹. These projects received €199.289m and 4.9% of it benefited to partners from the associated member states. Based on the output produced by the report of this programme, Turkey got full access to the European Union's new seven year research and innovation programme, Horizon 2020¹⁸⁰ by June, 4th 2014. It is a 7 years programme with nearly €80 billion funding available and expected to attract private investment. Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness¹⁸¹. By December, 1st 2014, the first 100 calls were closed¹⁸². According to a first report, the eligible applications and the share of partners from Turkey in signed grant agreements went down for Turkey compared to FP7. Up to now, 108 projects were signed under Horizon2020, with the participation of 144 partners under 34 coordinators¹⁸³. Among associated member states, Turkey is expected to get 6.6%, fourth position behind Switzerland, Norway and Israel.

Between 2007-2014 there are approximately 750 Turkish researchers and 308 Turkish organisations funded in Marie Curie action¹⁸⁴. EU budget awarded to Turkish organizations is estimated as €37.1m. The most important channel of transnational cooperation in the field of STI was the Seventh FP Program of the EU during the period 2007-2013. Since its closure, Turkish partners are part of the Horizon 2020 Program¹⁸⁵. The amount of funding obtained by Turkish partners for their participation to FP7 amounts to €200,3m over the period 2007-2013, which represents slightly less than 10 % of the total budget of the projects Turkish partners were involved with – i.e. 2,8 billion euros more precisely. The rate of return to Turkish contribution to FP7

¹⁷⁷ http://europa.eu/rapid/press-release_IP-16-145_en.htm

¹⁷⁸ ftp://ftp.cordis.lu/pub/era/docs/7fp_turkey_en.doc

¹⁷⁹ Data provided by IPTS.

¹⁸⁰ <http://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>

¹⁸¹ http://ec.europa.eu/europe2020/index_en.htm

¹⁸² https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf

¹⁸³ Data provided by the IPTS.

¹⁸⁴ http://ec.europa.eu/research/mariecurieactions/documents/funded-projects/statistics/non-eu/marie-curie-actions-country-fiche-tr_en.pdf

¹⁸⁵ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksekkurulu-28-toplantisi-6-ocak-2015>

programme, defined as the ratio of Turkish contribution to FP7 budget to amount of funding obtained by Turkish partners in the FP7, is 76%, which amounts to a more than doubling compared to the FP6 value of 32%. The most important share of the €200.3m goes to Cooperation program (€95.4m), then to Capacities (€54.5m), to Marie Curie Research Programs and Grants (€39m) and finally to Ideas program (€11.4m). Funds obtained by Turkish partners in FP7 projects amount to 29.4% of the corresponding total budget. The share of priority have share (energy, water, food, defense, space and health) of 25.4% of the total budget allocated to Turkish participants.

As for the Horizon 2020, based on the results of 38 calls opened in 2014, the funding obtained by Turkish partners (45 in number) in 2014 amount to 11.3 million euros. This figure represents 11% of the funding applied for by Turkish applicants and is not far from the average. Indeed, this proportion equals 13% for EU member countries, 10% for candidate countries and 12% for associated countries. The ratio of the funding obtained by Turkish applicants to national Turkish contribution to Horizon 2020 amounts to 25.6%.¹⁸⁶

Although not yet a Member State, Turkey's strategies and efforts in the field of S&T and innovation are, to a large extent, in line with the ERA pillars/objectives. Moreover, the national progress is almost in line with Innovation Union Commitments with the exceptions of screening key regulatory frameworks, eco-innovation action plan and monitoring innovation. In addition, R&D objectives of Turkey are analogous with the ERA targets. The ERA developments have been closely followed by the policy-makers and the BTYK launched the "Turkish Research Area" (TARAL) in 2004 with inspiration from the ERA.

Turkey has also participated to other transnational programmes and activities such as COST (European Cooperation in Science and Technology), ESA (European Space Agency), EMBC (European Molecular Biology Conference), BSEC (Black Sea Economic Cooperation), EIT (Economic Cooperation Organization), COMSTech (OIC Standing Committee on Scientific and Technological Cooperation), APSCO (Asia-Pacific Space Cooperation Organization), NATO, OECD and UNESCO.

In sum, the attempts towards transnational co-operation and competition have been successful to some extent and Turkey takes a way forward as compared to the levels at the beginning of the millennium. However, there are still structural problems to be solved and a long way to reach optimal levels of transnational co-operation and competition.

4.2.2 RI roadmaps and ESFRI

The ESFRI Roadmap identifies new Research Infrastructures (RI) for long term needs of the European research communities in all scientific areas. The Roadmap 2016 update process was launched in September 2014¹⁸⁷. Turkey's ESFRI is under

¹⁸⁶ According the information reached from the link below Turkey participate 108 projects with contribution of €26,293m.

http://vsnu.nl/files/documenten/Nieuwsberichten/Who_are_the_champions_in_Horizon_2020v2.pdf

¹⁸⁷ <http://www.copori.eu/1392.php>

preparation¹⁸⁸. The preparation of RI roadmaps and participation mechanism to international infrastructure based on priority areas and scientific capacity covering the period of 2011-2015 have been defined as main strategies in UBTYS 2011-2016¹⁸⁹.

4.3 International cooperation with third countries

In 1992, the Turkish International Cooperation and Development Agency (TIKA) was established. Its aim was to focus on developing cooperation mechanisms with newly founded countries after the fall of the Soviet Union. The main activity of the institution was defined as "the technical cooperation for the development of institutional capacity and human resources in partner countries". Turkey also provides training and advisory services, financing infrastructure projects and humanitarian assistance.

Among the official development assistance (ODA) of Turkey in 2013 bilateral assistance accounted for €2,291.76m (\$3,156.67m), €1,884.8m (\$2,596.12m) in grants, and €406.96m (\$560.55m) in concessional loans while Turkish multilateral contributions equalled €109.62 (\$151m).

The Ministry of Foreign Affairs also indicates that "Turkey is actively engaged in raising awareness in the international community and contributing to the efforts for finding solutions to the pressing problems of the Least Developed Countries (LDC)." In 2011, the Fourth UN Conference on the LDCs was held in Istanbul. International support measures were decided on the conference for the coming 10 years.

Turkey aims to raise direct investment to the LDCs, particularly from the private sector, to a total of \$5b by 2015 and to \$10b by 2020¹⁹⁰.

At the Sustainable Development Summit on 25 September 2015, UN Member States adopt the 2030 Agenda for Sustainable Development which includes a set of 17 Sustainable Development Goals (SDGs)¹⁹¹. In line with these goals, a Technology Bank for the Least Developed Countries is planned to be established. The Technology Bank is considered to contribute to the permeation of science, technology and the culture of innovation throughout societies. Turkey offers to take the leadership of hosting the Technology Bank at the campus of TUBITAK¹⁹² and planned to make a series of feasibility studies.

¹⁸⁸ https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri-national-roadmaps

¹⁸⁹ http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/strateji_belgeleri/UBTYS_2011-2016.pdf

¹⁹⁰ http://www.mfa.gov.tr/turkey_s-development-cooperation.en.mfa

¹⁹¹ <http://www.tr.undp.org/content/turkey/en/home/post-2015/sdg-overview.html>

¹⁹² <https://sustainabledevelopment.un.org/content/documents/2106Feasibility-Study-for-a-United-Nations-Technology-Bank-for-the-Least-Developed-Countries.pdf>

4.4 An open labour market for researchers. Facilitating mobility, supporting training, ensuring attractive careers and encouraging gender diversity

4.4.1 Introduction

Turkey is an associate member of the EU since 1963. In the EU accession process, the chapter on "free movement of workers" has not been opened yet and is currently unilaterally blocked by Southern Cyprus¹⁹³.

In 2014, 213,686 R&D personnel has been employed in Turkey which is 2.7 per thousand of the total population. 115,444 of the R&D personnel is working as FTE. Among these personnel; 181,544 people works as researcher which is 2.3 per thousand of total population. 89,657 of the researchers works as FTE. The researchers are generally employed by higher education institutes. 126,046 researchers, 69.43% of the total researchers, worked in higher education. 48,247 researchers employed in business entrepreneurs and 7,251 researchers employed in government institutes. However, FTE rate is only 32.7% among higher education researchers, 86.7% and 90% for business and government respectively¹⁹⁴ (TUBITAK, 2014).

4.4.2 Open, transparent and merit-based recruitment of researchers

TUBITAK initiated programmes for foreign researchers/ scientists to work and do research in Turkey for both short and long periods in order to increase researchers' mobility. In Turkey, 2,944 foreign teaching staff¹⁹⁵ was working in the universities during the 2014-2015 academic year. Moreover, graduate scholarships for international students are also available. Besides these, with EUREKA and FP7 programmes multinational cooperation is encouraged.

TUBITAK utilizes two support programmes for foreign researchers and academicians to facilitate working in Turkey. The first programme, "Fellowship for Visiting Scientists and Scientists on Sabbatical Leave¹⁹⁶", is for especially senior researchers who are on sabbatical leave. The second programme, "Co-Funded Brain Circulation Scheme¹⁹⁷", is especially for researchers in their early career. For non-citizen graduate students, two programmes are available. Talented and successful non-citizen graduate students are supported with "Graduate Scholarship Programme for International Students¹⁹⁸" programme. The non-citizen PhD students or post-doctoral researchers can utilize a

¹⁹³ One single member country by declaring her negative opinion can block the opening or closing of the chapters <http://www.abgs.gov.tr/index.php?p=65&l=2>

¹⁹⁴ TUBITAK R&D Statistics, tables of the report:

<http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18661>

¹⁹⁵ https://istatistik.yok.gov.tr/yuksekogretimIstatistikleri/2015/2015_T35_v2.pdf

¹⁹⁶ <http://www.tubitak.gov.tr/en/funds/academy/international-researchers-fellowship-programmes/content-2221-fellowships-for-visiting-scientists-and-scientists-on-sabbatical-leave>

¹⁹⁷ <http://www.tubitak.gov.tr/en/funds/academy/international-researchers-fellowship-programmes/content-2236-co-funded-brain-circulation-scheme-co-circulation-scheme>

¹⁹⁸ <http://tubitak.gov.tr/en/scholarship/undergraduatesgraduates/international-programmes/content-2215-graduate-scholarship-programme-for-international-students>

fellowship programme called "Research Fellowship Programme for Foreign Citizens"¹⁹⁹. Universal Researcher Programme (EVRENA)²⁰⁰ which was initiated in 2007 for five years encourages the collaboration between Turkish researchers and their foreign colleagues for joint research.

The two main international cooperation platforms are EUREKA²⁰¹ and Horizon 2020. EUREKA is an international cooperation platform to support firms for R&D projects. The main aim of EUREKA is to increase competitiveness in EU by raising cooperation between the member countries. Big Firms, SMEs, universities and research institutions can utilize research grants. EUREKA provides non-refundable funds for the projects of big firms and SMEs.

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

4.4.3 Access to and portability of grants

There are three main international support programmes used to encourage foreign researchers and academicians to come to Turkey by TUBITAK. The first one is 2216-Research Fellowship Programme for International Researchers. TUBITAK grants fellowships for international PhD students and post-doctoral researchers to pursue their research in Turkey in the fields of Natural Sciences, Engineering and Technological Sciences, Medical Sciences, Agricultural Sciences, Social Sciences and Humanities. In the research fellowship programme, the maximum grant is TL 2,250 (€793.6)²⁰² per month and is provided during 12 months maximum. In 2015, 269 foreign researchers applied TÜBİTAK 2216, and among them 86 had been supported²⁰³. By the end of 2015 total 254 researchers have been funded under this programme.

The second one is 2221 "Fellowship for Visiting Scientists and Scientists on Sabbatical Leave". There are three types of visiting grants in this program. For short term visiting scientists/researchers (up to 1 month) are encouraged to conduct workshops/conferences/seminars etc., give tutorials/lectures etc., and participate in R&D activities and to organize technical meetings for scientific and technological collaboration in Turkey. Visiting scientists/researchers are also encouraged for longer periods (up to 12 months) for conducting R&D activities and teaching graduate/undergraduate courses. These two programmes offer up to €2687 (\$3000)²⁰⁴ per month. Scientists and researchers are supported at least for three and at most for 12 months in their sabbatical leave and offered €3135 (\$3500) per month²⁰⁵. Travel and health insurance

¹⁹⁹ <http://tubitak.gov.tr/en/scholarship/undergraduatesgraduates/international-programmes/content-2216-research-fellowship-programme-for-foreign-citizens>

²⁰⁰ <http://www.tubitak.gov.tr/tr/destekler/akademik/ulusal-destek-programlari/icerik-1010-evrensel-arastirmaci-evrena-programi>

²⁰¹ www.eureka.org.tr

²⁰² €1=TL2.8351 (Central Bank of Turkey's banknote selling rate for 02.01.2015).

²⁰³ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²⁰⁴ £1=\$1.1164 (Central Bank of Turkey's cross rate for 02.01.2015)

²⁰⁵ <http://www.tubitak.gov.tr/en/scholarship/postdoctoral/international-programmes/content-2221-fellowships-for-visiting-scientists-and-scientists-on-sabbatical-leave>

expenses are also paid by the program. In 2013, 462 researchers applied to TUBITAK 2221, and among them 238 had been supported²⁰⁶. The number of applications increased by 16% compared to previous year and that of supported applicants increases by 8%. In 2015, 561 researchers applied to TUBITAK 2221, and among them 233 had been supported²⁰⁷.

The last support program is 2236- "Co-Funded Brain Circulation Scheme"²⁰⁸ which is co-funded by EC and by TUBITAK in the context of the 7th Framework Programme. This programme started in 2012 for a period of five years. The co-circulation scheme aims at increasing and facilitating international mobility of scientist and researchers. It is planned as four calls and expected to reach 100 researchers. The gross salary is €4167 (living allowance plus travel and mobility allowance) for experienced researchers with less than 10 years of experience and €4792 for senior researchers with more than 10 years of experience. An annual €7200 research contribution is managed by the hosting institution for the expenses related to the participation of the researchers in research and training activities. The total amount of the budget of this programme is €11.2m²⁰⁹. In 2015 67 applications made, and by the end of the year there were 101 actively funded researchers²¹⁰. The programme will not open applications next years.

In addition to three main international support programmes, two additional programmes are available for graduate scholarship of international students. The first one is "2215- Graduate Scholarship Programme for International Students"²¹¹. The main aim of the first programme is to support the successful international graduate and post-graduate students. International students are awarded two years maximum for master's studies and four years maximum for doctoral studies. MSc/MA students are awarded TL 1,500 (€529) per month, PhD students TL 1,800 (€634.89) per month.²¹² Tuition fee up to TL2,000 (€705.44)²¹³, and health coverage are also paid. Students who succeed in master's degree and who are admitted to PhD programs in Turkish Universities will also be rewarded. In 2015, 4415 foreign graduate student applied program, among them 61 had been supported²¹⁴. By the end of 2015, there are 635 funded students by this programme.

The second one is "2235- Graduate Scholarship Programme for Least Developed Countries". The grants are similar to those discussed for the 2215 programme. In 2015, 708 foreign graduate and post graduate student applied program, among them 29 had been supported²¹⁵. By Decision of TUBITAK in 5 September 2015, this programme is lifted. Although no new applications are accepted, 110 actively funded students are still supervised.

²⁰⁶ <http://www.tubitak.gov.tr/sites/default/files/istatistiklerle-bideb-2003-2013.pdf>

²⁰⁷ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²⁰⁸ <http://www.tubitak.gov.tr/en/funds/academy/international-researchers-fellowship-programmes/content-2236-co-funded-brain-circulation-scheme-co-circulation-scheme>

²⁰⁹ http://www.tubitak.gov.tr/sites/default/files/2015_malidurum_raporu.pdf

²¹⁰ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²¹¹ <http://www.tubitak.gov.tr/en/scholarship/undergraduatesgraduates/international-programmes/content-2215-graduate-scholarship-programme-for-international-students>

²¹² €1=TL2.8351 (Central Bank of Turkey's banknote selling rate for 02.01.2015).

²¹³ €1=TL2.8351 (Central Bank of Turkey's banknote selling rate for 02.01.2015).

²¹⁴ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²¹⁵ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

TUBITAK 2232 "Reintegration Research Fellowship Programme"²¹⁶ was launched in 2010 to encourage researchers to reintegrate Turkish Research Area. By 2012 not only post-doc researchers but also university graduates and researchers with a master degree were funded by the fellowship programme with a research budget up to TL 25000 (€8,818)²¹⁷. The grant is TL 3.250 (€1,146) per month and is provided during 24 months maximum. Having an acceptance letter from institutions carrying out R&D activities in Turkey, a condition for application, has been removed subsequently. Research support has been increased to TL 30000 (€10,581)²¹⁸. In 2015, 178 researchers applied to the programme and among them 67 had been supported and 29 had still under evaluation process²¹⁹. By 2015 386 researchers have been supported in total.

Moreover 2219 International Postdoctoral Research Fellowship Programme²²⁰ contributes the researchers' mobility. The aim of the programme is to contribute accumulation of knowledge at transnational level by encouraging international mobility of Turkish researchers. By this programme, Turkish researchers are supported to do research at abroad up to maximum 12 months. The grant is 2.500 USD / € 2.239 per month²²¹. In 2015, 1.568 researchers applied to TUBITAK 2219, and among them 341 had been supported and the process for 731 continued. By the end of 2015, 1711 researchers had been supported under this programme²²².

235 researchers through "European Union Marie Curie Actions and European Research Council Programme" and 360 researchers through national funds of BİDEB (Science Fellowships and Grant Programmes Department of TUBITAK) have been successfully reintegrated into Turkey in the previous 8 years²²³. Since the integration of TUBITAK 2232, 597 researchers have applied for reintegration to Turkish Research Area and among them 360 researchers have been funded.

In order to strengthen the human potential both quantitatively and qualitatively in the fields of science and technology of Turkey, TUBİTAK has established "Destination Turkey Initiative" in 2010. This initiative encourages researchers worldwide to be integrated into Turkish Research Area by having a full/part time position, having their sabbatical leaves, or spending their summer on conducting research in Turkish host institutions. The initiative is comprised of a series of workshops and conferences organized by TUBITAK in USA, Canada and Europe to create awareness on funding mechanisms that can be used by researchers wishing to reintegrate Turkey. These events have been organized in 12 different locations and reached to 500 high qualified researchers in America and Europe continents.

²¹⁶ <https://www.tubitak.gov.tr/en/news/tubitak-reverse-brain-drain-programme-met-with-success>

²¹⁷ €1=TL2.8351 (Central Bank of Turkey's banknote selling rate for 02.01.2015).

²¹⁸ €1=TL2.8351 (Central Bank of Turkey's banknote selling rate for 02.01.2015).

²¹⁹ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²²⁰ <https://www.tubitak.gov.tr/tr/burslar/doktora-sonrasi/arastirma-burs-programlari/icerik-2219-yurt-disi-doktora-sonrasi-arastirma-burs-programi>

²²¹ €1=\$1.1164 (Central Bank of Turkey's cross rate for 02.01.2015).

²²² http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²²³ <https://www.tubitak.gov.tr/en/news/tubitak-reverse-brain-drain-programme-met-with-success>

4.4.4 Doctoral training

Doctoral programs are organized by universities in accordance with the requirements set by the Council of Higher Education (YOK) at the national level²²⁴. The minimum acceptance requirements for the students are set by the graduate schools at universities²²⁵. Therefore, doctoral training is designed at the national level by YOK and implemented by universities with some degree of autonomy.

There are no systematic national-level measures addressing Innovative Doctoral Training. However the last BTYK report recommends to integration of doctoral training with R&D-conducting businesses. TUBITAK 1601 programme supports private R&D Centers (Law 5746), firms in technoparks (Law 4691) and private sector firms which are supported by TUBITAK previously and found successful in R&D if they employed doctorate holders²²⁶.

There are three main international support programmes used to encourage students and researchers to study or to do research at abroad by TUBITAK. The first one is 2214/A International Research Fellowship Programme²²⁷ for PhD Students. With this programme, PhD students, who are enrolled in PhD programs at the universities or research centers in Turkey, are supported to perform research abroad regarding their PhD thesis. The grant is \$1800 / € 1400 per month and is provided during 12 months maximum. In 2015, 766 researchers applied to TUBITAK 2214/A, and among them 238 had been supported and 356 application is still under evaluation²²⁸. By 2105, 984 students had supported in total.

Moreover there is a support programme for PhD students namely 2214/B - International Joint PhD Scholarship Programme²²⁹. By this programme, PhD students in Turkish universities are supported for their studies or research abroad within the context of joint PhD agreements. Maximum duration for the fellowship is 24 months. TUBITAK gives a monthly allowance as a lump sum payment, for every three periods. Travel costs are met by TUBITAK. In 2015, 12 PhD students applied to TUBITAK 2214/B, and among them 7 had been supported²³⁰. By 2015, in total 31 students had been supported under this programme.

2213 Overseas Graduate Fellowship Programme²³¹ is another programme that supports PhD studies of graduate students to get their PhD degrees at research centers or universities abroad, in the areas which are determined by TUBITAK's Scientific Council. The grant is \$1800 per month and is provided during 24 months maximum. In 2015,

²²⁴ The conditions are updated on 21.01.2015:

http://www.yok.gov.tr/en/web/guest/icerik/-/journal_content/56_INSTANCE_rEHF8BIsfYRx/10279/13282424

²²⁵ http://www.yok.gov.tr/en/web/guest/icerik/-/journal_content/56_INSTANCE_rEHF8BIsfYRx/10279/17377

²²⁶ http://www.tubitak.gov.tr/sites/default/files/1601d-cagrimetni_150604-rev.pdf

²²⁷ <http://www.tubitak.gov.tr/tr/duyuru/bideb-yurt-disi-arastirma-burs-programlari>

²²⁸ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²²⁹ <http://www.tubitak.gov.tr/tr/burslar/lisansustu/arastirma-burs-programlari/2214-b/icerik-burs-miktari-ve-odeme-kosullari>

²³⁰ http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

²³¹ <http://www.tubitak.gov.tr/tr/burslar/lisansustu/egitim-burs-programlari/icerik-2213-yurt-disi-lisansustu-burs-programi>

124 PhD students applied to TUBITAK 2213 and among them 31 had been supported²³². By 2015, in total 226 students have been supported under this programme.

4.4.5 Gender equality and gender mainstreaming in research

In Turkey, there is no direct measure or support of any public institution to encourage women in research activity. Total number of FTE female R&D personnel was 34,826 in 2014 which constitutes 30.2% of the total FTE R&D personnel. It was 34,246 in 2013 which constitutes 30.3% of total R&D personnel. The ratio of female R&D personnel in higher education was 42% in 2014 and 41.7% in 2013. This sector was followed by public sector by 25.7% and business sector by 23.2% in 2014. These were 25.2% and 23.1% in 2013, respectively. In 2013, 60,179 women are working as researcher in terms of head count while 29,361 of them employed as FTE. In all sectors the share of female FTE researcher as percentage of total employment is 0.38%. In government sector it is 0.02%, in business enterprises it is 0.13% and in higher education it is 0.23%.

In universities, by 2014 43.12% of the academic staff is female. In METU, Boğaziçi and Bilkent, three of the top universities of Turkey, the number of female academicians is higher. The total number of female academic staff in non-profit foundation universities is higher than total male staff. However, when we check top positions, the share of women decreases. The 26.28% of the professor staff are women while 50.16% of the academic staff is women in non-profit foundation universities. In state universities women consist 41.9% of the total academic staff and 29.7% of the professor ranks. Moreover, the share of women in administrative units is too low. In 2014, only 6.8% of the university rectors are women, 5.8% in state universities, 8.3% in non-profit private foundation universities.

In Turkey, labor force participation of women is low. However, the female share in academia is high. This indicates clustering of women in higher education institutes. On the other hand, it is shown that the FTE is relatively lower in universities. Furthermore, the high share of women in academia have not been reflected in top positions of universities.

Although there is no policy applied for gender discrimination in research by TUBITAK, positive discrimination for women and disabled entrepreneurs is implemented by KOSGEB's (Small and Medium Enterprises Development Organization) entrepreneurship support programme. According to this support programme, women and disabled entrepreneurs use 70% and 80% support ratio of non-refunded grants instead of 60% and 70%.

4.5 Optimal circulation and Open Access to scientific knowledge

4.5.1 e-Infrastructures and researchers electronic identity

TUBITAK manages the "Researcher Information System (ARBIS)" since 2004. In this system, information about the Turkish researchers from Turkey and other countries exist. The total number of researchers in the system is 102,483 in September 2015 while it was 93,552 in January 2014. Moreover, 1,228 institutions are registered to the system while this number was 1,169 in January 2014. ARBIS is a dynamic researcher database for national and international researchers who are

²³² http://tubitak.gov.tr/sites/default/files/1tubitak_2015_faaliyet_raporu.pdf

working in the universities, public or private institutions. The national or foreign researchers working in the universities, public research institutions, public or non-public organizations which perform R&D can become a member of ARBIS.

4.5.2 Open Access to publications and data

National Research and Education Network (ULAKNET) is a national provider for eduroam (education roaming) service and a member of European Confederation since 2007. Eduroam is the secure, world-wide roaming access service developed for the international research and education community. This service provides users with authenticated network logon and access to the Internet through a single Wi-Fi profile and set of credentials. Having started in Europe, eduroam has rapidly expanded throughout the research and education community and is worldwide available now. By the end of 2015, 94 institutions are member of TR eduroam Federation and service is covering 9026 access points at 856 different locations²³³

Turkey is a member of Education Roaming (EDUROAM) since 2007. The users of the member EDUROAM institutions are able to use their username and password to connect to the network of the other national or foreign EDUROAM institutions. National institutions which are using the National Academic Network (ULAKNET) can be a member when they apply for it. In January 2014, 77 institutions are registered to the system. EDUROAM Turkey covers 5980 access points at 643 different locations. In September 2015, 94 institutions are registered to the system covering 9026 access points at 797 different locations.

For improving the national gain from the investments in the areas of science and research, TUBITAK strongly encourages and supports Open Access. As of 2015, the necessary arrangements have been performed to have a national Open Access policy which will also be in line with international policies. In August 2015, TUBITAK ULAKBIM-National Open Access Committee has been founded to prepare directives to enable access to research outputs at low costs and to establish and implement Open Access policies in Turkey.

TUBITAK Science Archive has been established which give open access to every project will output where the project has been supported by TUBITAK. The archive will be important to collate all institutional archives in Turkey and will be integrated to the other systems in the European Research Area. In line with these efforts, the necessary infrastructure to be able to archive scientific data for longer periods has been completed.

JournalPark (DergiPark), which hosts and gives editorial service to more than 1145 national journals, is Turkey's first Open Access Platform that is standardised. JournalPark has increased the quality and international visibility of Turkish research.

Turkey is the 11th out of 100 countries that provides data to European Union Open Access portal: OpenAIRE.

SCOAP3 project has started as an Open Access project at CERN to centralize the payments that are given to high energy physics journals and provide Open Access to participating countries. In May 2014 Turkey TUBITAK ULAKBIM has signed an agreement with CERN to be responsible for this initiation.

²³³ <http://eduroam.org.tr>

5 Framework conditions for R&I and Science-Business cooperation

5.1 General policy environment for business

According to the Global Competitiveness Report 2015-2016²³⁴ of the World Economic Forum, Turkey is in the stage of transition from efficiency-driven economy to innovation-driven economy. In the Global Competitiveness index, Turkey ranks as 51st out of 140 economies and dropped six places as compared to 2014-2015 rankings and eight places as compared to 2012-2013 rankings. This result has been driven by a general decline in almost all factors driving competitiveness, with 10 out of 12 pillars registering a lower score than in 2014-2015. The assessment of institutions experiences the most severe drop, falling to 75th place. The political instability associated with economic instability along with the geopolitical conflicts have set a climate of uncertainty that tends to hold back private investments, especially those coming from international investors, which are crucial for Turkey's development. Turkey's performance in innovation pillar (56th) is comparable with other 'efficiency-driven economies' with a rank of 56. Under the innovation pillar, Turkey's scores relatively well in the 'government procurement of advanced technology products' (39th), 'PCT patent applications per million of population (42nd) and 'availability of scientists and engineers' (50th). Moderate performance is observed in 'university-industry collaboration in R&D' (61st). On the other hand, 'company spending on R&D' (79th), and 'quality of scientific research institutions' (82nd), and 'capacity for innovation (83rd) remain areas of concern for the country. In terms of the business sophistication pillar (58th), the best rankings belong to 'local supplier quantity' (27th), 'control of international distribution' (41st), 'production process sophistication' (43rd) and 'local supplier quality' (49th). However, Turkey performs significantly poor in 'nature of competitive advantage' (103rd). Finally, for technological readiness pillar (64th), the best ranking is for 'firm-level technology absorption' (36th) while 'venture capital availability' is the worst (93rd). In the same report, the most problematic factors for doing business are stated as tax rates, access to financing, inadequately educated workforce, foreign currency regulations, and complexity of tax regulations.

As another set of measures, World Bank "Doing Business Index"²³⁵ provides a base of comparison for the general policy environment for business. Among 189 economies, Turkey ranks as 55th in this index. The best rankings belong to 'protecting minority investors' (13th), 'getting electricity' (34th), 'enforcing contracts' (38th). However, the worst rankings are for 'dealing with construction permits' (136th), 'resolving insolvency' (109th), 'trading across borders' (90th) and 'getting credit' (89th). On the other hand, 'Starting a business' ranks as 79th.

In conclusion, it can be stated that recent political and economic instability accompanied with the geopolitical risks in the region make Turkey more fragile in the global scene. In Turkey, the most problematic areas seem to be underdeveloped

²³⁴http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

²³⁵<http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB15-Full-Report.pdf>

financial markets and educational infrastructures. Furthermore, insolvency regulations do not support financial reorganisation of enterprises. In Turkish business culture, willingness to take risks is not promoted. There is a discrimination against entrepreneurs who may have failed the first time around at some extent because of these cultural factors²³⁶.

5.2 Young innovative companies and start-ups

In Turkey, there exist support measures and increasing awareness on the need for specific support to young innovative companies and start-ups. In addition to UBTYS 2011-2016, a new decision towards developing policy tools to activate and to increase the number of R&D intensive start-ups were taken at the 23rd BTYK meeting in December 2011²³⁷. The decision considered a multi-stage support mechanism to speed up the number of young innovative companies and start-ups and create an eco-system to foster the capacity of such companies. For this end, risk and venture capital funds are planned to be established. The legislative framework for the partnership of public institutions to these funds and commercialization of R&D outcomes realized in public R&D centers were decided to be established. These decisions are significant steps forward for the support of young innovative companies and start-ups. As evident from the international examples²³⁸, these decisions have a potential to contribute the improvement for young innovative companies and start-ups. However, increasing the number of young innovative companies and start-ups is still one of the important structural challenges of the country as will be discussed in Section 6.1.

There are various initiatives for young innovative companies and start-ups through mechanisms especially designated to support entrepreneurship as discussed in Section 3.3.1. One of the most significant programme of TUBITAK toward entrepreneurship is "Support Programme for Multi-stage Entrepreneurship" with spending around €5m in 2014²³⁹. The name and the content of the programme was changed to "Technoentrepreneurship Support Programme" in 2015. Another significant programme towards commercialization of research activities is 'Support Programme for Technology Transfer Offices'. It aims to commercialize knowledge and technology in universities, to establish collaboration between universities and the private sector and to produce knowledge and technology demanded by the industry. This programme was announced in November 2012 and 10 TTOs was supported in the first call. Further 10 TTOs were also supported in the second call by the end of 2013. In 2014, 11 further applications are received and 5 of them are supported. These 25 TTOs will be supported for at most 10 years duration upon the results of annual

²³⁶ Gürbüz, G. And Aykol.S., 2009, Entrepreneurial management, entrepreneurial orientation and Turkish small firm growth, *Management Research News*, 32, 321-36. <http://www.emeraldinsight.com/doi/pdfplus/10.1108/01409170910944281> Alpan, L.et al., 2010, Organizational support for intrapreneurship and its interaction with human capital to enhance innovative performance, *Management Decision*, 48, 732-55.

²³⁷ <http://www.tubitak.gov.tr/tr/kurumsal/bilim-ve-teknoloji-yuksekkurulu/toplantilar/icerik-bilim-ve-teknoloji-yuksekkurulu-23toplantisi-27-aralik-2011>

²³⁸ Durufle G. (2010) Government involvement in the venture capital industry International comparisons; Canada's Venture Capital and Private Equity Association.

²³⁹ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksekkurulu-28-toplantisi-6-ocak-2015>

assessments. Venture Capital Support Programme" is started in August 2013 and received 16 applications of which 8 applications were supported. The program is a type of co-funding programme with TUBITAK grants. `Support Programme for Capacity Improvement in Innovative Entrepreneurship` was announced in 2014 and 9 applicants were supported. In the context of `Patent Support Programme` the cost of patent applications are supported by TUBITAK and €2.56m were granted to inventors in 2014²⁴⁰. `University- Industry Collaboration Support Programme` started in 2012 also aims the commercialization of R&D activities in universities. In 2014 , €1.66m were granted to 31 projects. As an important public body for SMEs, KOSGEB encourages the creation of techno-entrepreneurs through its "R&D, Innovation and Industrial Application Support Programme". Another support measure of KOSGEB is incubation centers called TEKMER. Through TEKMERs university-industry-public collaboration is enhanced. KOSGEB supports 43 TEKMERs in 27 different provinces. The programme provides incentives to 1,078 firms with a sum of €19.9m.

In the context of Law 5746 (R&D Activities Support Law), MoSIT provides "Techno-Initiative Capital Support Program" which was launched in 2009. Individuals who have an R&D project as well as certain qualifications (students with a doctoral degree or master's degree, etc.) are provided with grants of as much as TL 100.000 (€29,526). By the end of October 2014, 1,034 projects were supported in the period between 2009-2014 and the number of projects supported in 2014 is 270. Electronics and ICTs are the most popular areas receiving supports²⁴¹. Another support measure for some of the young innovative companies and start-ups is direct and indirect supports through Technology Development Zones²⁴². 59 Technology Development Zones were established and 41 of them were active until the end of October 2014²⁴³. By the end of October 2014, the number of firms in technology development zones has reached 2,956 (126 firms with foreign partners) and total number of employees is 29,903 with 6,902 R&D projects. On the other hand, total amount of high- tech exports in these zones are US\$5b (€3.98b) by the end of October 2014²⁴⁴. In these technology development zones, academic spin-offs are also supported yet the data on these spin-offs are not available.

According to the law of Regional Development Agencies (RDAs) which was enforced in 2006, the research/innovation-related duties of the agencies include (among others) supporting small and medium sized enterprises and start-ups in terms of management, production, promotion, marketing, technology, finance, organisation and human resources training in co-operation with relevant institutions. Besides the RDAs policy, no smart specialisation strategy for research and innovation was so far specified at the regional or national levels in Turkey. A recent mechanism introduced by MoSIT, Clustering Support Programme, to boost the transformation of Turkish industry

²⁴⁰ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

²⁴¹ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

²⁴² <https://biltek.sanayi.gov.tr/Sayfalar/tgb.aspx>

²⁴³ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

²⁴⁴ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

started in October 2013²⁴⁵. Until October 2015, two calls are published with the support of one cluster and the evaluation of the second call is still under review. There is a need to enrich the policy mix with instruments to support the commercialisation of innovative ideas such as innovation/knowledge clusters, creative clusters, knowledge transfer platforms, and voucher systems, notably for SMEs²⁴⁶. Programmes that provide additional funding to increase SMEs innovative capacities should be developed. The manufacturing expertise of SMEs should be supported together with the market-oriented technology funding of innovative SMEs. The cluster strategy should be a priority. The amendments in TUBITAK legislation provide some mechanisms for public-private partnerships yet tools to enhance public-private collaboration still seem to be weak.

5.3 Entrepreneurship skills and STEM policy

As discussed in Section 3.5.1, "Capacity Building for Innovation and Entrepreneurship Grant Programme" established in July 2013 aiming to support the efficient and productive use of public support in R&D and innovation and to improve national innovation and entrepreneurship ecosystem²⁴⁷. In the first call of this scheme, the theme was the establishment and implementation of entrepreneurship certificate programmes in universities in August 2013 by TUBITAK. 48 universities applied to this call and 14 of them were supported²⁴⁸. Various competition programmes toward entrepreneurship skills were designed by TUBITAK since 2013 in the higher education sector such as graduate projects competitions, software competitions, innovativeness and entrepreneurship competitions etc. In order to promote entrepreneurship culture, Ministry of National Education and TUBITAK signed a protocol for the training of teachers and administrators in vocational high schools ("Entrepreneurship and Leadership Trainings"). In the context of this programme, 6,598 teachers were trained. TUBITAK has also started an initiative for those that have already obtained support from the "Techno-Initiative Capital Support Program" of MoSIT. In the framework of this programme, 10 techno-entrepreneur out of 42 were selected to be trained in Silicon Valley, USA.

In Turkey, there exists the National Science and Technology Human Resources Strategy and Action Plan(2011-2016) (HRSTstrategy) to improve researcher careers. The strategy has two main purposes: increasing the number and improving the sectoral and occupational distribution of the R&D personnel. There is a need to balance supply and demand in HRST, and to increase the number of S&T graduates. The collaboration with industry for the design of new curriculum should be improved. Targets relative to the number of researchers are reached in a relatively short period of time in the recent decade. Nevertheless, the number of researchers, female researchers and, FTE researchers could be further increased with some additional policy measures.

²⁴⁵ <https://kumelenme.sanayi.gov.tr/Hakkinda.aspx>

²⁴⁶ <http://www.ebrd.com/downloads/research/transition/tr14e.pdf>

²⁴⁷ <http://tubitak.gov.tr/en/funds/industry/national-support-programmes/content-1601-capacity-building-for-innovation-and-entrepreneurship-grant-programme>

²⁴⁸ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksekkurulu-28-toplantisi-6-ocak-2015>

The attempts to enhance human resources for research are in the agenda in the last years. A specific strategy and action plan called 'National Science and Technology Human Resources Strategy and Action Plan (2011-2016)' were approved by BTYK in December 2010²⁴⁹. HRST Strategy has five main targets:

- Increasing the number of HRST and improvement of its sectoral distribution,
- Improving research culture, researchers' talents and experiences,
- Improving the work environment of HRST personnel,
- Increasing the mobility of researchers,
- Enhancing the employment opportunities of R&D personnel.

As compared to these attempts especially directed towards supply side of HRST, the attempts in the demand side is rather weak. The HRST needs of industry, public sector and universities are almost unknown. This lack of knowledge is an important barrier for an effective long-term planning in HRST.

In conclusion, despite all the attempts to improve entrepreneurship skills and HRST, there is still a long way to go for this issue in terms of the effectiveness of national research system. Moreover, a solid base of entrepreneurship and STEM policy should be established. The policy tools and mechanisms are revised very frequently as can be seen in some mechanisms such as TUBITAK's entrepreneurship and HRST policies. However, the first and the most urgent step seem to be mapping exercises, impact assessment and evaluation studies for the existing mechanisms.

5.4 Access to finance

Last couple of years have witnessed attempts toward the development of entrepreneurial activities and commercialization of research results. The first issue is also linked with the high-growth start-ups. Various funding programmes are developed concerning entrepreneurship supports. The underdeveloped venture capital and business angels markets, as well as the limited number and variety of policy measures for start-up creation, are crucial impediments for the establishment and development of innovative businesses in Turkey. It is also a barrier for encouraging educated and qualified human sources to see entrepreneurship as a career option. Insufficient early stage funding is also an obstacle for the development of venture capital industry as it helps to generate a large flow for venture capital investments. The BTYK decisions of December 2011 recognise this challenge and aims to address it through new policy measures. In order to provide grants to venture capital funds focusing on early (seed and startup) stage equity investments in innovative small and medium-sized enterprises which have the potential to develop innovative products, services and/or production processes, TUBITAK has initiated the "Venture Capital

²⁴⁹http://www.tubitak.gov.tr/tubitak_content_files//BTYPD/strateji_belgeleri/BT_IK_ST_RATEJI_BELGESI_2011_2016.pdf

(Private Equity) Funding Programme” in 2013. Furthermore, the Undersecretariat of Treasury carries out studies for improving the framework conditions for angel investments, and the ‘Entrepreneurship Council’ established in January 2012 aims to increase the number of innovative and technology-based start-ups. The regulations published in February and August 2013 by the Undersecretariat of Treasury provide a legal basis for new tax exemptions for business angels²⁵⁰. However, one of the main shortcomings of access to finance is the requirement of a centrally collected database. In Turkey, the aggregate data on funding supply levels have not been published yet. There exist strategies for developing venture capital industry and encouraging early stage investments. However, there is an urgent need to create favourable conditions to foster a growing and robust venture capital market, especially for early stage investments. The next step is the mapping exercises of channels to access to finance. Public efforts to enhance venture capital funds are ineffective mainly because of coordination problems. Another fact is the low interest of private sector funds because of insufficient incentives. One of the main observations from the field is that especially SMEs and start-ups do not have sufficient human capital resources and capability to reach new financial opportunities through venture capital supports and business angel networks²⁵¹. Although, the newly established TTOs and administrative apparatus of organized industrial districts are evolving for this end, the awareness and administrative organization is not still at a mature level.

In accordance with BTYK’s no. 2015/103 decision, by the end of 2015 KOSGEB has designed a new support programme that named International Incubation Center and Accelerator Support Programme. In the context of this new support programme, KOSGEB is going to provide support for establishment costs and equipment costs and also operational costs of operator organization of incubation centers that will be established abroad.

University companies that established for the purpose of establishing and managing incubation centers and administrative companies of Technology Development Zone individually or as a consortium would apply this programme.²⁵²

5.5 R&D related FDI

No recent official data is available on the volume of R&D intensive FDI investments for the Turkish economy, at the macro or sector level²⁵³. Although different surveys conducted by the Turkish Institute of Statistics, and especially the annual R&D survey²⁵⁴, would easily make it possible to construct this kind of statistics, the

²⁵⁰ <http://www.hazine.gov.tr/File/?path=ROOT%2fDocuments%2fGenel+%c4%b0%c3%a7erik%2fBKS%2fYon+etmelik+Degisiklik.pdf>

²⁵¹ <http://stps.metu.edu.tr/strategic-analysis-ict-sector-ankara>

²⁵² For detailed information about new support programme please refer to: <http://www.kosgeb.gov.tr/>

²⁵³ OECD (2010), *Measuring Globalisation. OECD Economic Globalisation Indicators*, OECD, Paris. 2003 is the last year for which official data is available about the share of foreign R&D in total manufacturing R&D in Turkey (16%). See also European Commission (2012), *Internationalisation of business investments in R&D and analysis of their economic impact*, EC, Brussels.

²⁵⁴ http://www.tuik.gov.tr/PreTablo.do?alt_id=1082

fact is that no such data is constructed or if constructed, not published or sent to multilateral organizations for publications.

Turkey seems to prepare and implement strategies and policies to promote R&D activities on the one side, and attract FDI on the other side. However, there does not seem to exist an integrated strategy which aims to attract R&D intensive FDI. A thoroughly conducted study on this issue by the International Investors' Association (YASED) points in this direction²⁵⁵. There are a number of R&D support measures of which foreign firms can profit at the same degree as domestic firms. These are especially the grant-based R&D project funding provided by TUBITAK TEYDEB in the framework of its TUBITAK 1501 (Industrial R&D Support Program) program. The submissions and evaluation procedures of R&D projects are the same for domestic and foreign firms – no discrimination exists, in principle as the list of TEYDEB beneficiary lists indicates²⁵⁶. Findings of interviews²⁵⁷ conducted with the representatives of a number of foreign firms operating in Turkey indicate that the existence of this type of direct R&D funding seems to have been instrumental to some extent in increasing the attractiveness of Turkey as a R&D hub. Tax incentives provided in the framework of the Technology Development Zones (TDZs) law (Law No 4691) are also another instrument foreign firms use to carry out R&D activities. As is visible in Figure 4 below, clearly the total number of foreign firms (with or without domestic partners) located on TDZs has increased on a sustained basis from 2003 to 2014 (end October 2014), the rate of growth being especially important from 2012 to 2014 (end October 2014): indeed, this number increased from 70 in 2012 to 112 in 2013 and to 126 in 2014 (end October 2014), pointing to the attractiveness of this indirect support structure/indirect support measures as far as FDI is concerned. Moreover, the number of foreign firms located on R&D Centers established in accordance with the Law No 5746 (Law on Supporting Research and Development Activities) has increased steadily over the period 2012 to 2015 (mid-October): this number is 28 in 2012, 30 in 2013, 33 in 2014 and 38 in 2015 (mid-October)²⁵⁸. The "Frontier R&D Laboratory Support program" of TUBITAK TEYDEB (TUBITAK 1515²⁵⁹), launched in the second half of 2014 aims to sustain the activities of R&D laboratories in the long-run. It also aims to enhance the quality of research conducted by Turkish scientists and establish Turkey as a global hub in certain scientific and technological fields. This program has the potential to attract R&D-intensive FDI to Turkey since it funds up to 75% of eligible R&D laboratory expenses.

²⁵⁵ <http://www.yased.org.tr/webportal/Turkish/Yayinlar/Pages/RaporTurEkonoYabanciArg.e.aspx>. See also Erdil, E. and M. T. Pamukçu (2015) "Analysing R&D Activities of Foreign Enterprises in Emerging Economies: Lessons from Turkey", in David Dyker (ed.), *The World Scientific Reference on Globalization in Eurasia and the Pacific Rim: Investment, Innovation, Energy, Migration and Development* (4 volumes), World Scientific Reference, 215-246

²⁵⁶ http://www.tubitak.gov.tr/sites/default/files/web_firma_1995-mart2013.pdf

²⁵⁷ <http://stps.metu.edu.tr/yased>,
http://stps.metu.edu.tr/sites/stps.metu.edu.tr/files/1104_0.pdf

²⁵⁸ Data provided by the Ministry of Science, Technology and Industry

²⁵⁹ <https://www.tubitak.gov.tr/en/funds/industry/national-support-programmes/content-1515-frontier-rd-laboratory-support-programme>

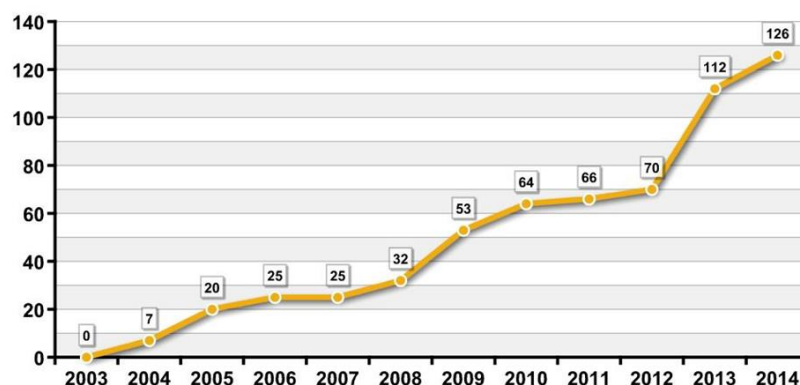


Figure 4. Nur of foreign firms in TDZs (data for 2014 refers to October 31st)
Source: Report submitted to the 28th meeting of the Supreme Council of Science and Technology

Finally, non-discriminatory -independent of the nationality of the capital owner-funding supports provided within framework of one of the strategic objectives of National Science and Technology Strategy 2011-2016 ("multipartner and multidisciplinary R&D Collaboration") do have the potential to attract R&D intensive FDI flows²⁶⁰. In accordance with the Regulation relative to State Aids to Investment²⁶¹ published in the official Gazette of June, 19th 2012, those R&D investments with the potential to contribute to technological change and transformation in Turkey will benefit from the following support measures: (i) VAT exemption (ii) import duty exemption (iii) low interest rates and (iv) for certain geographical regions, lower income taxes and social security contributions. The Ministry of Economy is in charge of the implementation of this regulation.

Aforementioned different types of non-discriminatory support measures, mechanisms, legislation etc. are meant to exert a positive impact on R&D-intensive FDI.

5.6 Knowledge markets

Different rules and regulations covering issues related to intellectual property rights, i.e. industrial property rights, copyright, geographical signs and industrial designs, exist in Turkey. The legal and institutional infrastructure has been in place for two decades. The decree law on the Protection of Patent Rights²⁶² was published in the Official Gazette on June, 27th 1995 and its applications rules²⁶³ on November, 5th 1995. The law on copyright and related rights are subject to the Law No 5846 on Intellectual and Artistic Works. Both laws are currently under revision for the following reasons: (i) adaption to evolutions on the international scene (ii) efforts aimed at EU acquis harmonization in the field of IPR (iii) mitigation of problems arising from their

²⁶⁰ http://www.tubitak.gov.tr/sites/default/files/btyk28_gelismeler.pdf

²⁶¹ <http://www.resmigazete.gov.tr/eskiler/2012/06/20120620-8.htm>

²⁶² <http://www.mevzuat.gov.tr/MevzuatMetin/4.5.551.pdf>

²⁶³ <http://mevzuat.basbakanlik.gov.tr/Metin.Aspx?MevzuatKod=7.5.5175&MevzuatIliski=0&sourceXmlSearch=patent>

current implementation in Turkey (iv) providing an effective and more productive structure to Turkish Patent Institute (established in 1994) and (v) strengthening of innovation development capacity of SMEs.

The new amendments about the law on intellectual property rights and industrial design rights opened to signature to the council of ministers on 11th of March 2013. In this draft law, it is proposed to change 92 items²⁶⁴. The Draft Law contains many amendments in order to modernize the IP system and to harmonize the national law with EU law and international agreements. The most important change in the law is about the inventions of the university members. The academic inventors and their rights on the invention have been modified in detail. To avoid the arguments between the academic inventor and her/his institution, the rights of the inventor and institution have been classified in a more detailed way. In the original law, the right of the patent application belongs to the academician, however with this amendment this right conveys to the university. Moreover, the university can now own a patent. Therefore, it is expected an increase in license income through the commercialization of university inventions and this license income may be used for financing future researches by universities. Another important point pertains to the penalty on the infringement of patent rights: counterfeiting becomes an offence punishable by imprisonment from one to three years.

A number of measures -direct and indirect- have been implemented recently in order to increase patenting propensity of entities in Turkey. The Patent Support Program of TUBITAK (TUBITAK 1602²⁶⁵) was launched in January 2014 with the objective of increasing the number of national and international patent applications made by individuals and legal entities residing in Turkey. Applications made to the Turkish Patent Institute, European Patent Office, WIPO, Japan Patent Office and USPTO are all eligible for support. Grants are provided to cover all applications costs and later a cash reward is provided if the patent is granted. 1,976 national and 339 international patent applications were made within the framework of the support program over the period January- October 2014, and a total amount of 7.1 million TL was provided as grant.

The Law No 6518 was published in the Official Gazette in February, 19th 2014²⁶⁶. It aims to promote via tax incentives the commercialization and volume production of patented inventions. This law targets inventions arising from R&D, innovation and software activities undertaken in Turkey. Revenues arising from licensing or due to the cession and sale of these inventions are exempted from corporate tax up to 50%. These incentives also include VAT exemptions for these transactions.

Consulting services and trainings aimed at the development of intellectual property strategies by firms have been carried out within the framework of Hezarfen Technology and Design Development Project²⁶⁷. The aim of this project is multifold: (i) informing SMEs about the wealth of knowledge contained in patent documents and (ii) determining the technological status of SMEs so as to assist them through

²⁶⁴ https://www.tbmm.gov.tr/develop/owa/tasari_teklif_sd.onerge_bilgileri?kanunlar_si_ra_no=122700

²⁶⁵ <https://www.tubitak.gov.tr/tr/destekler/sanayi/ulusal-destek-programlari/icerik-1602-tubitak-patent-destek-programi>

²⁶⁶ <http://www.resmigazete.gov.tr/eskiler/2014/02/20140219-1.htm>

²⁶⁷ <http://www.tpe.gov.tr/TurkPatentEnstitusu/allNews/newsDetail?newsId=216>

consulting services on the path to technological development (preparation of technological roadmap). Therefore, this project consists of consulting services and general or specific trainings oriented towards firms and aims at nurturing an innovation culture and enhance innovation development capacities of SMEs. It has been implemented recently in Kayseri and Eskisehir in 2013, in Izmir and Antalya in 2014.

Another IPR promotion is undertaken by the Turkish Patent Institute²⁶⁸. Its target group is academicians, researchers and R&D employees in universities and occurs through conception and application of patent instruction programs in universities. Besides, several exhibitions and open days on IPR-related issues organized in several universities in 2014.

After consultations involving several governmental bodies including the Ministry of Science, Technology and Industry as well as the Turkish Patent Institute, a National Geographical Signs Action Plan and Strategy Document was drafted for the 2015-2018 period and accepted by the Supreme Council of Planning. This decision was published in the Official Gazette on June, 15th 2015²⁶⁹. Implementing measures and policies aimed at developing local and regional products and spurring regional economic development through promotion of geographical signs are the main objectives of this law.

In a similar vein, an Industrial Design Strategy Document and Action Plan was prepared and published in the Official Gazette on November, 2nd 2014²⁷⁰. Its main objectives are (i) contribution to the creation and protection of industrial designs in Turkey respecting the environment (ii) ensuring international and sustainable competitiveness for designers in our country, and (iii) developing an administrative, legal and technical infrastructure in order for Turkish designs to be recognized worldwide. The main goals and instruments required to attain these objectives are (i) transformation of the current design legislation to make it more consistent with international standards (ii) increasing the number and the scope of supports in this area (iii) increasing the awareness related to design along the education path and training designers capable of creating designs in harmony with environment and full of economic potential, and (iv) enhancing communications and collaboration between the actors related to design activities.

Similar to entrepreneurship UBTYS 2011-2016 is in favor of the preparation of class material about IPRs to be taught at the high school and university levels – which, contrarily to entrepreneurship-related issues has not been implemented yet. Another measure aimed at promoting IPRs is to increase the/give more weight/importance of/to patent applications as promotion criteria of academicians in Turkey – which is definitely not the case now, number of academic publications being the major criteria for academic promotion.

Several mechanisms that facilitate the acquisition of industrial property rights by researchers or their transfer from academia to industry, including cash support for national and international patent applications, the establishment of Technology Transfer Offices at universities, the extension of the law establishing Technology

²⁶⁸ http://www.tubitak.gov.tr/sites/default/files/btyk28_gelismeler.pdf

²⁶⁹ <http://www.resmigazete.gov.tr/eskiler/2015/07/20150704-7.htm>

²⁷⁰ <http://www.resmigazete.gov.tr/eskiler/2014/11/20141102-6.htm>

Development Zones located on university campuses -and supposedly enhancing university-industry cooperation- from 2013 to 2023 and the reduction in 2014 from 50 to 30 of the minimum number of research personnel required to benefit from the R&D subsidies according to law No 5746, which will hopefully lead more SMEs to apply to this program.

5.7 Knowledge transfer and open innovation

Technology Development Zones (TDZs), established on university campuses in accordance with the law no 4691²⁷¹, have attracted a number of academicians who founded technology development companies (spinoffs) and operated in TDZs in order to take advantage of tax incentives offered therein. The number of academic entrepreneurship operating in TDZs reached 824²⁷² on September 2015. Moreover, the number of projects involving collaboration with academicians amounted to 2,307 (the number of projects closed was 17,498 and in progress was 8,029) by the end of September 2015.

A support program promoting industry-university collaboration through private funding of academic work is Industrial Thesis (SAN-TEZ) Projects Support Program (SAN-TEZ²⁷³) managed by the Ministry of Science, Industry and Technology (MoSIT). The target group of the program are SMEs and its aim is to support graduate theses with the potential to increase innovativeness, high-value added production and to enhance the competitiveness of the country. SMEs are expected to solve their technological problems through collaboration with universities. The proportion of the SAN-TEZ budget funded by the SMEs changes from 15% to 35% while the rest is provided by the MoSIT.

An example of cooperation program between the public sector and academia is provided by the "Support Program for Research and Development Projects of Public Institutions" funded by TUBITAK (TUBITAK 1007²⁷⁴). It consists of the Public Research Grant Group (KAMAG) and Defense and Security Technologies Research Grant Group (SAVTAG). The objective of the program is to solve R&D-based problems of these institutions and reply their R&D-based requirements via result-oriented R&D projects. It also aims to create R&D awareness in public institutions.

"Support Programme for Technology Transfer Offices" aims to commercialize knowledge and technology in universities, to establish collaboration between universities and the private sector and to produce knowledge and technology demanded by the industry. This programme was announced in November 2012.³⁹ applications have been received to this call. 10 TTOs was supported in the first call. Further 10 TTOs were also supported in the second call by the end of 2013. In 2014, 5

²⁷¹ <http://www.resmigazete.gov.tr/eskiler/2014/03/20140312-2.htm>

²⁷² <http://www.resmigazete.gov.tr/eskiler/2014/03/20140312-2.htm>

²⁷³ <http://www.sanayi.gov.tr/userfiles/file/SanTez%20G%C3%BCncel%20D%C3%B6k%C3%BCmanlar/genel%20bilgiler.pdf>

²⁷⁴ http://www.tubitak.gov.tr/sites/default/files/kamu_kurumlari_arastirma_ve_gelistirme_projelerini_destekleme_programi_1007_programi_kapsamindaki_projelere_iliskin_idari_ve_mali_esaslar_0.pdf

TTOs were also supported²⁷⁵. These 25 TTOs will be supported for at most 10 years with an annual budget of 1 million TL (€0.30m). By October 2014, the supported 20 TTOs received €6.4m²⁷⁶.

While various interfaces like technology parks, incubators, TTO's etc. were created to speed up to innovative activities of firms and enhance university-industry interactions, there is no real strategy plan on knowledge transfer among university and industry. There is an urgent need to create favorable conditions to foster a growing and robust venture capital market, especially for early stage investments as it is evident from Global Competitiveness Report 2015-2016. As noted in Section 5.1 by using the data of World Bank "Doing Business Index", the rules and procedures and streamline processes for starting up, running and terminating a business should be improved for the success of the entrepreneurship incentives. As mentioned in this study, the rules for starting up and running a business are complex and not designed from an SME perspective. In addition, heavy bureaucratic applications and red tape are still observed.

A number of universities set up collaboration programs to promote industry-university collaboration in some specific sectors based on funds provided by the Ministry of Development. There are, however, no centrally collected data nor any evaluation studies on these initiatives.

In the 28th meeting of the Supreme Council of Science and Technology a decision was taken to develop and later implement an International Incubation Center Support²⁷⁷. The objective of the support is double: (i) enhancing the brand recognition on export markets of technology-based products developed through domestic R&D activities and (ii) positioning of technology-intensive start-ups in advanced entrepreneurship ecosystems. The main implementing organizations of this support mechanism would be universities. The word "international" here means that these incubation centers would be established outside Turkey in technologically dynamic countries.

5.8 Regulation and innovation

There does not exist any study – of a qualitative or a quantitative nature – aimed at analyzing the impact of regulation on innovative activities in Turkey. Although the legal framework in Turkey contains numerous economic, social and institutional regulations, studies pertaining to their impact on innovation activities of firms have not been carried out. Although the existing wide range of economic (competition, mergers and acquisitions, antitrust regulation), social (environmental production, product and consumer safety) and institutional regulations (especially intellectual property rights) affects most likely all types of innovation activities to some degree, no study²⁷⁸ has been conducted to this date in order to analyse their

²⁷⁵ <http://www.tubitak.gov.tr/tr/duyuru/1513-ve-1601-tto-2014-cagri-sonuclari-aciklandi>

²⁷⁶ <http://www.tubitak.gov.tr/tr/icerik-bilim-ve-teknoloji-yuksek-kurulu-28-toplantisi-6-ocak-2015>

²⁷⁷ http://www.tubitak.gov.tr/sites/default/files/70_yeni_2015_103.pdf

²⁷⁸ www.basbakanlik.gov.tr/Handlers/FileHandler.ashx?Field=20781

impact on innovative activities. The absence of such studies is observed for regulations that might affect directly or indirectly innovation. Therefore, one can conclude that the paucity of impact assessment studies on R&I support measures pointed to in section 2.2.1 is also a valid point for the regulatory environment present in Turkey.

5.9 Assessment of the framework conditions for business R&I

Developing, implementing and sustaining a strategic, coherent and integrated policy framework has been an important objective among policy-makers. Measures aimed at disseminating R&D culture and innovation cooperation, stimulating sectoral and regional R&D and innovation, encouraging SMEs to become stronger actors within the national innovation system, and enhancing the contribution of research infrastructures to knowledge creation capacity of the Turkish Research Area are all part of this policy framework. Mission-oriented approaches in areas with strong RDI capacity, need-oriented approaches in areas with demand for gaining acceleration, and bottom-up approaches (basic, applied and frontier research) identified under UBTYS 2011-2016 act as focusing devices. Diversification of funding schemes through design and implementation of supports aimed at commercialization and entrepreneurship besides research supports is also a move in the correct direction. In addition, selection of projects on the basis of quality by making use of external peer review process has improved the quality of funded projects. Through a number of support programs, considerable effort has been made to increase mobility of researchers at the sectoral, national, international levels, contributing in this way to the diffusion of knowledge in the country. Several support programs aim also to contribute to capacity building in business firms, especially SMEs (mentoring) and improve the access of young innovative firms to finance (business angels, venture capital). However, there are major challenges and major problems to be dealt with in order to keep moving forward if not stumbling back.

First of all, there have been no monitoring and evaluation exercises conducted for the numerous R&D funding programs present in Turkey since the mid-nineties. The current situation constitutes, hence, a major obstacle when it comes to determine the effectiveness of these programs and whether their results were in accordance with the objectives assigned. Moreover, in spite of the existence of a Coordination Council for R&D a lack of coordination exists between different governmental bodies when it comes to design and implement support programs which may result in the duplication of the same public support scheme and, hence, lead to waste of resources. Carrying out comprehensive monitoring and impact evaluation activities on a sustained basis is all the more important given the lobbying activities of interest groups which might be opposed to societal needs and, hence, misdirect research activities. In addition, starting up, running and terminating a business are still costly activities associated with heavy bureaucratic obstacles and red tape. This inhibits the birth and development of entrepreneurs and of entrepreneurial activities. Another obstacle entrepreneurs face on the way to commercialization is access to funds provided by venture capital and business angels, given the weak development of these two entities in Turkey. Finally, rules and regulations governing mobility of researchers between public and private sectors should be improved.

There exist some measures to stimulate public procurement of innovative solutions to improve public services, including through dedicated budgets and joint

procurement. The recent BTYK decisions especially support public procurement in ICT area. The BTYK decision aiming at improving public procurement and public right of use in such a way to foster innovation, localisation and technology transfer is also an opportunity yet the development of policies and incentives to stimulate innovation in the public sector and in the delivery of public services are needed.

6 Conclusions

6.1 Structural challenges of the R&I system

According to the European Innovation Scoreboard 2016 Turkey is a **Moderate Innovator**²⁷⁹. Innovation performance has been improving at a slow but steady rate between 2008 and 2014, and for 2015 a sharp increase can be observed. Turkey is catching up to the EU; its relative performance has improved from 38% in 2008 to 39% in 2014 and then jumped to 51% in 2015 turning the country from a Modest into a Moderate Innovator. The performance improvement is the result of an almost twelvefold increase in Non-R&D innovation expenditures and a more than fourfold increase in Sales share of new product innovations using CIS 2012 data as compared to CIS 2010 data.²⁸⁰ However, in terms of linkages and entrepreneurship indicators (SMEs innovating in-house, innovative SMEs collaborating with others, public-private co-publications), 3.1% to 3.6% negative changes has been observed.

There are recent attempts in Turkey in order to cope with the challenge of academia-business cooperation and mobility. In this regard, Ministry of Science, Industry and Technology introduced Government-University- Industry Cooperation Strategy and Action Plan for the years 2015 to 2018. Sample realized actions in the Government-University- Industry Cooperation Strategy Plan for the benefit of open labour market for researchers in HEIs. First, barriers to flexibility in personel affairs of academic staff are removed for the benefit of Industry -Academy Cooperation. Academic personnel are now enabled to be employed in the R&D and design centers of private sector as full-time or half-time employee. Academicians can work in industry for a temporary period while keeping his/her academic staff statute. They can make use of this opportunity up to 1 year as full time employees after each six year period with the permission of university governing board. Second, circulating capital of the university is redesigned for the benefit of academic staff who is engaged in university-industry cooperation. There is a net %85 gain of the revenue from the industry academy cooperation activities for academic staff without any deduction or income tax exemption. Third, a new mechanism of encouragement allowances for academic staff is designed; which is also in line with the third mission of HEIs. National or international registered patents, projects financed by private sector, industrial thesis projects are among the criteria for the calculation of the final score for the encouragement allowance of each academic staff. Fourth, there has been an amendment in the application criteria for associate professorship so as to include patents, start-ups and previous experience as a coordinator/researcher in research projects.

²⁷⁹ European Innovation Scoreboard 2016
<http://ec.europa.eu/DocsRoom/documents/17822>

²⁸⁰ http://www.knowledgetransferireland.com/About_KTI/Reports-Publications/European-Innovation-Scoreboard-2016.pdf

Another remarkable shift is the move from research to innovation. In addition, research and innovation is increasingly seen as a driver for competitiveness and growth and jobs in many sectors and to stimulate investment in general. This still requires a comprehensive strategy on how to achieve this. The government considers an ecosystem approach centred on the business sector and entrepreneurs crucial for a well-functioning innovation system. Support for entrepreneurship and SMEs is therefore one of the priorities of the Supreme Council for Science and Technology (SCST). Several decrees and policy initiatives have recently been put in place, such as the International Incubation Centre in 2015 and the Acquisition of Foreign High-Tech Companies and R&D Centres of International Enterprises, both in 2014. MoSIT started the Technological Products Promotion and Marketing Programme in 2013 and the Technological Products Investment Support Programme in 2014. Both target firms that have previously received public/international R&D and innovation support.

The Incubation Centre and Accelerator Support Programme also addresses the challenge of increasing international cooperation as it intends to support Turkish companies on international markets e.g. by facilitating global market penetration of products or providing special support to start-ups, and utilising knowledge capacity of Turkish researchers living abroad. In 2016, the SME Development Organisation (KOSGEB) granted USD 4 million PPP (TRY 5.2 million) for the establishment of incubation centres in the United States only. Moreover, the Investment Support and Promotion Agency (ISPAT) is in the process of developing a new investment support and promotion scheme to attract foreign R&D investments. Researchers are also encouraged to conduct research abroad via several fellowships or grant programmes. The Academy of Sciences (TÜBA) has implemented a new award programme to foster international mobility of researchers in 2015. In addition, in order to facilitate technology transfer from abroad, the Directive on Support for Market Research and Penetration was amended in 2015.

With respect to innovation, Turkey has taken several measures identified in the Innovation Union flagship and there is still room for improvement, as Turkey intends to do, in particular to stimulate cooperation between Academia and Industry and develop new technologies and products.

All efforts mentioned above should also contribute to the process of harmonization with the *acquis communautaire on research and innovation (Accession Chapter 25)*. Turkey is actively reforming, there is commitment to act sufficiently in line with the EU *acquis* and notably with the ERA priorities. Turkey, as a country associated to the EU research and Innovation Programme 'Horizon 2020', has been invited to prepare a National Roadmap in line with ERA. There is commitment of TUBITAK and leading universities to launch actions for compliance to ERA priorities. Turkey has from the very beginning followed the actions in ERA and establish already in 2015 its own ERAframework. "Turkish Research Area" (TARAL) launched by BTYK (Supreme Council of Science and Technology) inspired by ERA.

Based on the discussion above, the following challenges have been identified for Turkey :

- *Promoting research commercialisation from universities*: This can take place in various forms, such as university start-ups and spin-offs, mobility of researchers and students, contract research projects, joint research projects, innovative public procurement, licensing, consulting, trainings, formal and informal networks, competitiveness clusters etc. This is also underlined by the Global Competitiveness

Index in which Turkey has a relatively weak performance. The relatively limited correlation between specialisation in science and specialisation in technologies suggests that the knowledge transfer towards industry through technologies is limited in Turkey. The decisions of the 23rd meeting of BTYK and the National Science, Technology and Innovation Strategy 2011-

2016 focus on this challenge. The Entrepreneurial and Innovative university Index has been established. Universities included in this index are eligible to apply for support to establish technology transfer offices. In 2013, 10 such offices have been supported. Another 10 are received the support in 2014 and 5 more in 2015.. The enrichment of the policy mix with a variety of measures (financial, non-financial, etc.) will help to address this challenge.

- *Increasing the number of innovative high-growth start-ups*: This is an important challenge facing the innovation and economic performance of the country. The underdeveloped venture capital and business angels markets, as well as the limited number and variety of policy measures for start-up creation, are crucial impediments for the establishment and development of innovative businesses in Turkey. It is also a barrier for encouraging educated and qualified human resources to see entrepreneurship as a career option. Insufficient early stage funding is also an obstacle for the development of venture capital industry as it helps to generate a large flow for venture capital investments. The BTYK decisions of December 2011 recognise this challenge and aim to address through new policy measures. Furthermore, the Undersecretariat of Treasury carries out studies for improving the framework conditions for angel investments, and the 'Entrepreneurship Council' established in January 2012 aims to increase number of innovative and technology-based start-ups²⁸¹.

- *Increasing R&D and innovation capabilities of the private sector (in particular, micro, small and medium enterprises (MSMEs))*: The low levels of absorptive capacity of the business sector, particularly that of MSMEs, is a barrier to increase R&D and innovation performance. MSMEs constitute 99.9% of the total enterprises and 78% of employment in Turkey, according to KOSGEB. Micro enterprises constitute the majority of MSMEs. They are mainly active in traditional, middle to low-tech sectors, such as garments (14%), furniture (14%), metal products (14%), wood products (10%) and food (8%) (KOSGEB 2011)²⁸². There exist policy measures for increasing R&D and innovation investment of the private sector and SMEs, and the National Science, Technology and Innovation Strategy 2011-2016 highlights the role of SMEs. It is important to design and implement specific measures (such as support for R&D/innovation vouchers and knowledge intensive service activities, etc.) for enhancing the learning capabilities, absorptive capacity, and R&D and innovation capabilities of MSMEs and other private sector companies.

- *Focusing on strategic approach on access to finance*: According to the Global Competitiveness Report 2015-2016²⁸³ of the World Economic Forum, 'venture capital availability' has one of the worst ranking indicators (93rd) in Turkey. The underdeveloped venture capital and business angels markets, as well as the limited number and variety of policy measures for start-up creation, seem to be

²⁸¹ <http://www.sanayi.gov.tr/NewsDetails.aspx?newsID=2292&lng=tr>

²⁸² <http://www.kosgeb.gov.tr/Pages/UI/Baskanligimiz.aspx?ref=23>

²⁸³ http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

significant barriers for the establishment and development of innovative businesses in Turkey. The impact of existing strategies should be evaluated and the policy mix should evolve based upon these evaluations. The frequent changes in entrepreneurship supports may have the potential to destabilize the ecosystem.

- *Increasing availability and quality of research personnel:* As evident by indicators, Turkey has a very low share in knowledge-intensive activities, partly explained by the importance of employment in the agriculture, construction and tourism sectors. This has long been recognised as one of the challenges of the Turkish research and innovation system by the government and specific interventions have helped improvements in trends. Current strategies and action plans indicate ongoing commitment in this area. Further efforts and diversified measures are needed to develop human resources in a way that the absorptive capacity of companies is enhanced, and the quantity and quality of researchers are increased. The BTYK decisions of December 2011 and August 2012 support the steps to be taken to tackle this challenge.

A summary of these challenges is presented in Table 4:

Table 4. Structural Challenges of National R&I System

| Challenge | Main Conclusion |
|--|---|
| Promoting research commercialisation from universities | The enrichment of the policy mix with a variety of measures (financial, non- financial, etc.) will help to address this challenge |
| Increasing the number of innovative high-growth start- ups | The underdeveloped venture capital and business angels markets, as well as the limited number and variety of policy measures for start-up creation, are crucial barriers. |
| Increasing R&D and innovation capabilities of the private sector | The low levels of absorptive capacity of the business sector, particularly which of MSMEs, is a barrier to increase R&D and innovation performance. |
| Focusing on strategic approach on access to finance | The impact of existing strategies should be evaluated and the policy mix should evolve based upon these evaluations. |

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|---|---|
| Increasing availability and quality of research personnel | Further efforts and diversified measures are needed to develop human resources in a way that the absorptive capacity of companies is enhanced, and the quantity and quality of researchers are increased. |
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6.2 Meeting structural challenges

In Turkey, there exist various instruments to tackle structural challenges as summarized in Table 5. The assessment of each policy measure/action addressing a challenge is put forward in Table 5 below, the most significant shortcoming of all these measures being the inexistence of evaluation studies on these support programmes. Although the establishment of evaluation office at MoSIT is a step forward, another concern is an urgent need to develop an evaluation culture and establish an effective mechanism for systematic evaluation of the public R&D funding system, policies and policy measures on the basis of internationally recognised criteria. Therefore, without an attempt of systematic impact assessment and evaluation studies, it is not possible to evaluate the consequences of the current funding system. Turkey is a support schemes' heaven in some sense yet it has not been evaluated whether these schemes result in optimal outcomes or if sub-optimal ones are obtained. Therefore, how to deal with the difficulties are not clear. For instance, although various interfaces like technology parks, incubators, TTO's etc. were created to speed up the innovative activities of firms and to enhance university-industry interactions, there is no real strategy pertaining to

knowledge transfer among university and industry. There is an urgent need to create favourable conditions to foster a growing and robust venture capital market, especially for early stage investments. Moreover, the rules and procedures and streamline processes for starting up, running and terminating a business should be improved for the effectiveness of entrepreneurship incentives. The rules for starting up and running a business are not simple nor designed from an SME perspective. Heavy bureaucracy in applications and red tape are still observed. Although the legal framework seems to be transparent and up-to-date, clientelism is a fact at some instances.²⁸⁴ Another measure to be introduced is the development of efficient standard-setting system supporting innovative products and services.

²⁸⁴ Ocakli, F., 2016, Political entrepreneurs, clientelism, and civil society: supply-side politics in Turkey, *Democratization*, 23, 723-746.

Luca, D., 2016, Boon or bane for development? Turkey's central state bureaucracy and the effective management of public investment, *Environment and Planning C: Government and Policy*, 34, in print, doi:10.1177/0263774X16670666

| Challenges | Policy measures/actions addressing the challenge | Assessment in terms of appropriateness, efficiency and effectiveness |
|--|--|---|
| <i>Challenge 1.</i> Promoting research commercialisation from universities | Law on Technology Development Zones Establishment of Technology Transfer Offices Industrial Thesis Support Programme (SAN-TEZ) University-Industry Collaboration Support Programme | These measures are appropriate but it is not possible to state that the desired level of research commercialisation is reached. The enrichment of the policy mix (financial, non-financial, etc.) is needed. |
| <i>Challenge 2.</i> Increasing the number of innovative high-growth start-ups | Law on Supporting Research and Development Activities-Techno-entrepreneurship Support Programme Support Programme for Pre- Competitive Collaboration Projects SME RDI (Research, Development & Innovation) Grant Programme Individual Entrepreneurship Support Programme Venture Capital Support Program Innovative Entrepreneurship Capacity Enhancement Support Programme | There exist strategies for developing venture capital industry and encouraging early stage investments. However, there is an urgent need to create favourable conditions to foster a growing and robust venture capital market, especially for early stage investments. |

| | | |
|---|---|---|
| <p><i>Challenge 3.</i> Increasing R&D and innovation capabilities of the private sector</p> | <p>Law on Supporting Research and Development Activities Industrial R&D Projects Support Programme R&D, Innovation and Industrial Application Support Programme International Industrial R&D Projects Grant Programme</p> | <p>Research and innovation started to play a more important role in the overall national/sectoral/regional policy mix. There is an increased commitment among the policy-makers to develop and implement strategic, coherent and integrated policy framework. It is an important challenge to achieve and sustain such a policy framework. There is a need to adopt a broad concept of innovation in policies and policy measures (including innovation in services, improvements of processes and organisational change, business models etc.)</p> |
| <p><i>Challenge 4</i> Focusing on strategic approach on access to finance</p> | <p>Individual Entrepreneurship Support Programme Venture Capital Support Program Innovative Entrepreneurship Capacity Enhancement Support Programme</p> | <p>The impact of existing strategies should be evaluated and policy mix should evolve based upon these evaluations. The frequent changes in entrepreneurship supports may have potential to destabilize the ecosystem.</p> |

| | | |
|---|---|--|
| <p><i>Challenge 5</i> Increasing availability and quality of research personnel</p> | <p>National Young Researcher Career Development Programme</p> <p>Research Fellowship Programme for Returning Turkish Scholars</p> <p>National Post-Doc Research Fellowship Programme International Post-Doc Research Fellowship Programme</p> <p>Co-Funded Brain Circulation Scheme</p> | <p>There exists the National Science and Technology Human Resources Strategy and Action Plan (2011-2016) (HRST strategy) to improve researcher careers. In the last decade, FTE R&D Personnel increased by 176% while FTE Researchers by 148%. There is a need to balance supply and demand in HRST, and to increase the number of S&T graduates. The collaboration with industry for the design of new curriculum should be improved. The number of researcher targets is reached in a relatively short period of time in the recent decade. Nevertheless, the number of researchers, female researchers and, FTE researchers should be further increased with some additional policy</p> |
|---|---|--|

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Abbreviations

| | |
|----------|--|
| ARBIS | Researcher Information System/ Arařtırmacı Bilgi Sistemi |
| ARDEB | Research Support Program Directorate of TUBITAK/ Arařtırma Destek Programları Başkanlıđı |
| BERD | Business Expenditures for Research and Development/ Özel Sektör Tarafından Gerçekleřtirilen AR-GE Harcamaları |
| BIT | Information and Communication Technologies/ Bilgi ve İletişim Teknolojileri |
| BTYK | Supreme Council of Science and Technology/Bilim Teknoloji Yüksek Kurulu |
| COST | European Coordination in Science& Technology/Bilim ve Teknolojide Avrupa İşbirliđi |
| EDURAM | Education Roaming/Eđitim Dolařım Altyapısı |
| EIT | Economic Cooperation Organization/Ekonomik İşbirliđi Teřkilatı |
| EMBC | European Molecular Biology Conference/Avrupa Moleküler Biyoloji Konferansı |
| ERA | European Research Area/Avrupa Arařtırma Alanı |
| ESA | European Space Agency/Avrupa Uzay Ajansı |
| EU | European Union/Avrupa Birliđi |
| EU-28 | European Union including 28 Member States/28 AB Üyesi Ülke pa İşbirliđi |
| EUROSTAT | European Statistical System/Avrupa İstatistik Ofisi |
| FP | European Framework Programme for Research and Technology Development/Arařtırma ve Teknoloji Geliřtirme Avrupa Çerçeve Programı |
| FP7 | 7th Framework Programme/ 7. Çerçeve Programı |
| FTE | Full Time Equivalent/ Tam Süreli Eřdeđer |
| GBAORD | Government Budget Appropriations or Outlays on R&D |
| GDP | Gross Domestic Product/ Gayri Safi Yurtiçi Hasıla (GSYİH) |
| GERD | Gross Domestic Expenditure on R&D/ Gayri Safi Yurtiçi AR-GE Harcaması |
| GOVERD | Government Intramural Expenditure on R&D/ Kamu Kesimi Tarafından/ Gerçekleřtirilen Ar-Ge Harcaması |

| | |
|--------|---|
| GUF | General University Funds/ Genel Üniversite Fonu |
| HEI | Higher education institutions/ Yükseköğretim Kurumları |
| HERD | Higher Education Expenditure on R&D/ Yükseköğretim Kurumları Tarafından/ Gerçekleştirilen Ar-Ge Harcamaları |
| HRST | Human Resources for Science and Technology/ Bilim ve Teknoloji İçin Beşer Sermaye |
| IMF | International Money Fund/ Uluslararası Para Fonu |
| IUS | Innovation Union Scoreboard/ İnovasyon Birliği Karnesi |
| KEI | Black Sea Economic Cooperation/ Karadeniz Ekonomi Birliği |
| KOSGEB | Small and Medium Sized Enterprises Development Organisation/ Küçük ve Orta/ Ölçekli İşletmeleri Geliştirme ve Destekleme İdaresi Başkanlığı |
| LDC | Least Developed Countries/ En Az Gelişmiş Ülkeler |
| MoD | Ministry of Development/ Kalkınma Bakanlığı |
| MoE | Ministry of Economy/ Ekonomi Bakanlığı |
| MoNE | Ministry of National Education/ Milli Eğitim Bakanlığı |
| MoSIT | Ministry of Science, Industry and Technology/ Bilim, Sanayi ve Teknoloji Bakanlığı |
| MoF | Ministry of Finance/ Maliye Bakanlığı |
| NATO | North Atlantic Treaty Organization/ Kuzey Atlantik Anlaşması Örgütü |
| NGO | Non-Governmental Organization/ Sivil Toplum Örgütleri |
| NIS | National Innovation System/ Ulusal Yenilik Sistemi |
| ODA | Official Development Assistance/ Resmi Kalkınma Yardımları |
| OECD | Organisation for Economic Co-operation and Development/ Ekonomik Kalkınma ve İşbirliği Örgütü |
| OSYM | Measurement, Selection and Placement Centre/ Öğrenci Seçme ve Yerleştirme Merkezi |
| PRO | Public Research Organisation / Kamu Araştırma Kurumları |
| RDA | Regional Development Agency/ Bölgesel Kalkınma Ajansları (BKA) |
| RI | Research Infrastructures/ Araştırma Altyapıları |
| RTD | Research and technology Development/ Araştırma ve Teknolojik Gelişme |

| | |
|----------|--|
| RIS3 | Regional innovation strategies for smart specialisation |
| SAN-TEZ | Industrial Thesis Support Programme/ Sanayi Tezleri |
| S&T | Science and Technology/ Bilim ve Teknoloji |
| STI | Science, Technology and Innovation/Sanayi, Teknoloji ve Yenilik |
| SME | Small and Medium Sized Enterprise/Küçük ve Orta Ölçekli İşletme (KOBİ) |
| TARAL | Turkish Research Area/ Türkiye Araştırma Alanı |
| TİKA | Turkish International Cooperation and Development Agency/ Türk İşbirliği ve Koordinasyon Ajansı Başkanlığı |
| TPE | Turkish Patent Institute/ Türkiye Patent Ofisi |
| TSE | Turkish Standards Institute/ Türk Standardları Enstitüsü |
| TTGV | Technology Development Foundation of Turkey/ Türkiye Teknoloji Geliştirme Vakfı |
| TTO | Technology Transfer Office/ Teknoloji Transfer Ofisi |
| TUBA | Turkish Academy of Sciences/ Türkiye Bilimler Akademisi |
| TUBİTAK | Scientific and Technological Research Council of Turkey/ Türkiye Bilimsel ve Teknolojik Araştırma Kurumu |
| TURKSTAT | Turkish Statistical Institute/ Türkiye İstatistik Kurumu (TÜİK) |
| UBTYS | National Science, Technology and Innovation Strategy/ Ulusal Bilim, Teknoloji ve Yenilik Stratejisi |
| ULAKNET | National Academic Network/ Ulusal Akademik Ağ ve Bilgi Merkezi |
| UNESCO | The United Nations Educational, Scientific and Cultural Organization/ Birleşmiş Milletler Eğitim, Bilim ve Kültür Örgütü |
| YOK | Higher Education Council/ Yükseköğretim Kurulu Başkanlığı |
| YPK | High Planning Council/ Yüksek Planlama Kurulu |

List of the main research performers

University Ranking by Academic Performance (URAP) lists the universities based on the 5 different variables: article points, total references, total scientific documents, doctoral student points, academic personal/ student points. Ranking is Hacettepe University, Middle East Technical University (METU), Istanbul University, Istanbul Technical University, Ege University, Ankara University, Bilkent University, İhsan Doğramacı Bilkent University, Gebze Advance Technology Universities and Gazi University. Meanwhile TUBİTAK announced The Entrepreneurial and Innovative University Index

2015: Sabancı University, METU, Bogazici University, Bilkent University, Koç University, Istanbul Technical University, Özyeğin University, İzmir High Technology Institute, TOBB ETU and Yıldız Technical University.

According to 2014 R&D ranking of the world top 2,500 companies, there are 6 firms listed in the database. These are as follows:

| world rank | NAME | Industrial Sector (ICB-3D) |
|------------|---|-----------------------------------|
| 1106 | KOC | General Industrials |
| 1169 | ASELSAN ELEKTRONIK SANAYI VE TICARET | Technology Hardware & |
| 1247 | FORD OTOMOTIV | Automobiles & Parts |
| 1432 | TOFAS | Automobiles & Parts |
| 1451 | VESTEL ELEKTRONIK | Electronic & Electrical Equipment |
| 2108 | IPEK DOGAL ENERJİ KAYNAKLARI ARASTIRMA VE | Support Services |

Evaluations, consultations, foresight exercises

Although systematic evaluation of any kind -ex ante, intermediary and ex post- of support R&D programs policies has not carried out yet, The Division of Impact Evaluation was established in 2014. The main goals of the Division of Impact Evaluation is providing necessary information and knowledge to policy and decision makers in order to for them to (i) design efficient policies, (ii) determine whether or not support programs have the expected impact (iii) provide/obtain information necessary for the support programs to be developed and restructured. Its main missions and duties include/are described/announced as (i) collection and conservation of data and information necessary to conduct studies on impact evaluation and performance indices (ii) organization of workshops, seminars and conferences aimed at learning and applying different techniques to be used in impact evaluation studies, (iii) conducting analyses in the framework of the impact evaluation exercises and construction of performance indices and (iv) communication/sharing of reports and documents on the activities of and studies realized by the Division to those organizations and institutions of interest. The Division of Impact Evaluation has been conducting (ongoing studies on) impact assessment exercises on Industrial Thesis Support Programme (SAN- TEZ), Techno-entrepreneurship Support Programme, R&D Centers established according to Law No

5746 on Supporting Research and Development Activities and Technology Development Zones established according to Law No 4691.

UBTYS 2011-2016 is prepared for sustainable technological and innovative developments to achieve Vision 2023 goals. One of the strategic objectives of the UBTYS 2011-2016 is bridging the gap between research-oriented activities and innovation in the Turkish economy.

The vision of the strategy is defined as "to contribute to new knowledge and develop innovative technologies to improve the quality of life by transforming the former into products, processes, and services for the benefit of the country and humanity."³⁰⁴. The challenges for the new period are defined as spread the culture of multi-partner,

multi-disciplinary R&D and innovative cooperation; encourage the role of the actors in innovative system of SME's; increase the contribution of research infrastructure to information production of TARAL. The strategy outlines mission oriented approaches in areas with strong RDI capacity, need-oriented approaches in areas with a demand for gaining acceleration, and bottom-up approaches including basic, applied and frontier research are identified.

Science and Technology Human Resources Strategy and Action Plan 2011-2016 targets to increase the number and improving the sectoral and occupational distribution of the R&D personnel.

National Energy R&D and Innovation Strategy defines four strategic targets, namely mission-oriented prioritized R&D projects, capacity improvement, commercialization and collaboration. Moreover main missions defined as establishing global competitiveness through the production of knowledge and innovative outputs using resources efficiently and productive and considering quality of environment and life.

National Water R&D and Innovation Strategy describes four strategic targets as the improvement of database infrastructure, mission-oriented prioritized R&D projects, capacity improvement, and socioeconomic and hydropolitic research. Moreover main missions defined as improving unique technologies and policies for the protection of water resources, productive and sustainable use of water resources, and the protection of access rights of all livelihoods to water. National Food R&D and Innovation Strategy describes six strategic targets, production of raw materials, industrial R&D and innovation activities, local capabilities and innovative products, food consumption and health, mission-oriented prioritized R&D projects, and sustainability and environment-friendly technologies. Moreover, main missions defined as producing high value added, innovative and branding food products with environmental-friendly technologies.

Vision 2023 (Vizyon 2023) Policy Document counted as the first foresight exercise in Turkey. The technology foresight was started as part of the effort to design a new science and technology policy for Turkey. As the latest policy in force, 'Turkish Science and Technology Policy 1993-2003' was due to come to an end, BTYK on its sixth meeting on December 2000, took the decision to create a new national science and technology policy for the period of 2003 to 2023 for Turkey (BTYK, 2000, p. 14). This decision was accompanied by the preliminary project proposal for the preparation of a strategy document. The preliminary project proposal comprised of 5 sub-projects - a long-term 'technology foresight' sub-project, the 'determination of Turkey's technological balance of payments' sub- project, 'monitoring the national innovation system and determining the mechanisms for creating incentives' sub-project, 'inventory of Turkey's researchers' sub-project and the 'evaluation of Turkey's R&D systems' organizational infrastructure with an analytical inventory of the existing legislation' sub-project. For all proposed sub-projects, TÜBİTAK was assigned the task of project coordinator (BTYK, 2000, pp. 13-24).

In pursuit of this task, TÜBİTAK started its preparations by first examining the science and technology policies made in Turkey and their implementation until then. It was believed that the success of the new policy would as well depend on a clear comprehension of the previous experiences and the mechanisms that had led to their failure or success. The study led to the conclusion that although the previous policies produced some beneficial results and improvements, the targets were missed by far. One of the main reasons that had led to this failure was attributed to lacking social support and lacking ownership of the political authority. Furthermore, it was

determined that science and technology policy issues should not be treated in isolation but required a holistic approach, one that links them to social and sectoral policies and the national innovation system (TÜBİTAK, 2004c, pp. 8-

10). Thus, the design of the process towards the creation of a new science and technology policy was dominated by the search for methodology that would relate policy to social and economic needs while at the same time eliminating the disadvantage of lacking commitment experienced thus far. The preparatory phase took about a year and included the examination of the science and technology policies of many other countries and the methods of devising these. As a result of this effort, the 'Vizyon 2023: Science and Technology Strategies' project based on technology foresight as its essential component was detailed and presented to 7th BTYK meeting in December 24, 2001 (BTYK, 2001).

The project scope was altered from the preliminary proposal, so that there now were 4 sub-projects included: Technology Foresight, National Technology Inventory, R&D Human Resources and National R&D Infrastructure.

Besides the need for a new S&T strategy, Turkey's candidacy to the European Union (EU) has been an essential driver of the Turkish foresight efforts throughout. Both BTYK decisions of December 2000 and December 2001, address this issue. The decision to join the EU Framework Programs, taken by the Supreme Council in December 2000 (BTYK, 2000, p. 25), coincides with the decision to create a new S&T policy for Turkey. The December 2001 meetings' decisions point out that technology foresight is utilized as a policy tool to devise long-term S&T policies worldwide and that foresight programs have either been already completed or are ongoing in almost all EU member and candidate countries - the implication being that Turkey had to emulate this course and base S&T strategy on foresight (BTYK, The rationale of the initial BTYK decision of December 2000 taken with regard to the preparation of a new national S&T strategy points out that previous science and technology policies bear the characteristic of adopting the goals of developed countries to Turkey and are not based upon any technological foresight. It was therefore deemed necessary to develop new strategies based on foresight that also incorporate alternative scenarios for Turkey (BTYK, 2000, p. 13). The preliminary project proposal for the preparation of the new national S&T strategy entails that an 'action plan' for Turkey covering the period 2003-2023, based on at least three alternative scenarios be developed (BTYK, 2000, p. 15). This 'scenarios approach' that was initially intended does neither appear in the BTYK, nor in the TÜBİTAK documentation any further and there is no clue as to why it was later dropped from the agenda.

The initial proposal furthermore includes the forming of a steering committee that will supervise the projects' progress. TÜBİTAK is designated to serve as the secretariat to this committee and is assigned the task of project coordinator while the State Planning Organization, DPT, is designated as a supporting organization (BTYK, 2000, p. 15). TÜBİTAK, the State Planning Organization (DPT), The State Statistics Institute (DİE), The Turkish Academy of Sciences (TÜBA), Technology Development Foundation of Turkey (TTGV) and The R&D Department of the Ministry of Defense (MSB/ARGE) are designated as the projects' executing organizations.

In the 2001 BTYK decisions where the final form of the project with respect to the preparation of the strategy document was approved, TÜBİTAK is designated as the 'responsible' organization and the organizations that later comprised the steering committee are mentioned as 'associated' organizations.

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